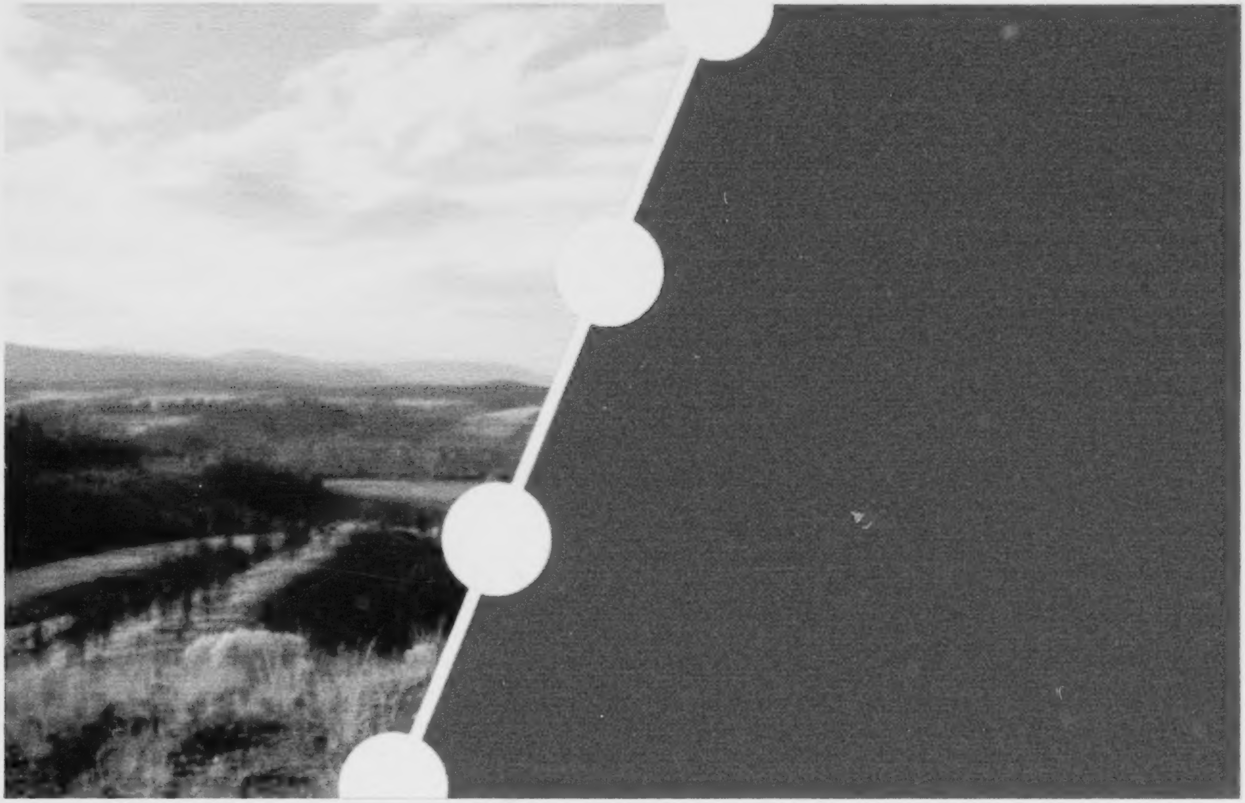
Canadian Environmental Assessment Agency
Agence canadienne d'évaluation environnementale

EAO Environmental Assessment Office

Ajax Mine Project

Joint Federal Comprehensive Study / Provincial Assessment Report



August 2017

Canada

BRITISH COLUMBIA

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Executive Summary

KGHM Ajax Mining Inc. proposes to construct, operate and decommission an open pit copper and gold mine adjacent to the southern limits of the City of Kamloops in British Columbia. The Ajax Mine Project would process up to 65,000 tonnes of ore per day over an operating mine life of up to 23 years.

The Ajax Mine Project would have a footprint of approximately 1,700 hectares and would include an open pit, ore processing plant, tailings storage facility, mine rock storage facilities, and water and waste management systems. It would also include upgrades to an existing water intake on Kamloops Lake, a new 16 kilometre water line to transport water to the mine site, and a new 5.3 kilometre natural gas pipeline connecting with the Fortis pipeline near the community of Knutsford. A new 9 kilometre, 230 kilovolt transmission line would tie in with an existing BC Hydro power line near Knutsford to supply electricity to the Ajax Mine Project. The Inks Lake Interchange would be upgraded to provide direct access to the mine site from Highway 5 (Coquihalla Highway).

The Ajax Mine Project was subject to review under both federal and provincial environmental assessment legislation, and a coordinated environmental assessment was carried out by the Canadian Environmental Assessment Agency (the Agency) and the BC Environmental Assessment Office (EAO). The Agency and EAO prepared a joint federal Comprehensive Study/provincial Assessment Report that meets the requirements of both the *Canadian Environmental Assessment Act* and British Columbia's *Environmental Assessment Act*, and which will inform separate environmental assessment decisions on the Ajax Mine Project by federal and provincial ministers.

The Ajax Mine Project would require various permits and authorizations from federal, provincial, and local governments. Should a provincial Environmental Assessment Certificate be issued, extensive permits under a number of provincial statutes would be required before it could proceed. The primary regulators for the construction and operation of mines in BC are the Ministry of Energy, Mines and Petroleum Resources, under the *Mines Act*, and the BC Ministry of Environment and Climate Change Strategy, under the *Environmental Management Act*. Federal authorizations would be required from Fisheries and Oceans Canada and Natural Resources Canada, under the *Fisheries Act* and the *Explosives Act*, respectively. These authorizations trigger the requirement for a comprehensive study under the *Canadian Environmental Assessment Act S.C. 1992, c. 37* (the former Act). The *Canadian Environmental Assessment Act, 2012* (CEAA 2012) came into force on July 6, 2012, replacing the former Act. In accordance with the transition provisions of CEAA 2012, the comprehensive study for the Ajax Mine Project is being completed under the former Act. KGHM Ajax Mining Inc. would also need to apply for local government authorizations from the Thompson Nicola Regional District and the City of Kamloops.

The joint federal Comprehensive Study/provincial Assessment Report presents the Agency and EAO's analysis and findings on whether the Ajax Mine Project is likely to cause significant adverse effects, taking into account the implementation of mitigation measures and the EAO's proposed Environmental Assessment Certificate conditions. The joint federal Comprehensive Study/provincial Assessment Report also describes the Agency and EAO's joint and individual consultation activities with Indigenous groups, and provides an assessment of the seriousness of impacts from the Ajax Mine Project on the Aboriginal Interests (i.e. Asserted or established Aboriginal rights, including title) of each group.

The Agency and EAO's consultation activities with the public included five public comment periods, some with associated information sessions, between 2011 and 2017. The EAO also established a Community Advisory Group in 2012, composed of a variety of stakeholder organizations that had demonstrated an interest in the effects of the Ajax Mine Project. Over the course of the environmental assessment, the Community Advisory Group met formally with the EAO and Agency, and provided direct review and comment on project related documents in addition to those opportunities available to the general public.

The Agency and EAO conducted the environmental assessment in consultation with a working group comprising representatives of federal, provincial, and local governments, including the City of Kamloops, as well as representatives of potentially affected Indigenous groups. In preparing the joint federal Comprehensive Study/provincial Assessment Report, the Agency and EAO considered technical information provided by KGHM Ajax Mining Inc., expert advice from the working group, and comments provided by Indigenous groups and the public.

The City of Kamloops also conducted direct public engagement related to Ajax throughout the EA. With financial assistance from KGHM Ajax Mining Inc., the City of Kamloops retained a consulting firm to conduct a technical review of KGHM Ajax Mining Inc.'s Environmental Impact Statement/Application for an Environmental Assessment Certificate. The City of Kamloops provided input to the Agency and EAO through the working group for consideration as part of the technical review.

In July 2015, Stk'emlupsemc te Secwépemc Nation (SSN) Joint Council formally initiated development of their own community-based review called the SSN Assessment Process. The Agency and EAO considered information submitted by SSN from its process in the assessment of effects to valued components and the assessment of impacts to SSN's Aboriginal Interests. The Agency and EAO will also provide the outcome of SSN's assessment process to the federal and provincial ministers to help inform their environmental assessment decisions.

Potential key adverse effects examined during the environmental assessment include:

- Decrease in water quality in the Peterson Creek watershed;
- Changes to groundwater and surface water quantity in the vicinity of Jacko Lake and Peterson Creek downstream of the mine site;
- Loss of fish habitat in Peterson Creek and Jacko Lake, and direct mortality to fish in Jacko Lake;
- Loss of grouse, American badger, and great basin spadefoot toad habitat;
- Potential to disrupt sleep and to disrupt or annoy residents from noise and vibration;
- Increase in human health risk resulting from increased exposure to dust and particulate matter, and metals in air and country foods;
- Decrease in the angling experience on Jacko Lake;
- Increased pressure on traffic, temporary accommodation and health services during construction;
- Changes to Indigenous heritage; and
- Changes to current use of lands and resources for traditional purposes by aboriginal persons.

Mitigation measures to reduce or eliminate potential adverse effects were developed during the course of the environmental assessment. Key mitigation measures include:

- Construction of water management ponds to capture seepage and surface contact water from mine features, such as the mine rock storage facility and the tailings storage facility, which includes an underdrain system in the tailings embankment foundation and a liner system;
- Capture and storage of contact water for re-use in the processing plant, which would reduce overall water requirements;

- Diversion of non-contact water back to the watershed to minimize water losses;
- Implementation of the Fish Habitat and Fishery Offsetting Plan to compensate for the loss of fish habitat and fish mortality;
- Implementation of blast designs that include measures to protect fish and fish habitat and minimize disturbances to Jacko Lake and its recreational and Indigenous users;
- Development of wetland and grassland habitat compensation to mitigate loss of wildlife habitat;
- Flagging sensitive areas to avoid loss of wildlife habitat;
- Avoiding vegetation clearing during breeding/rearing periods;
- Installation of dust collectors on key mine infrastructure components to minimize air quality and health effects;
- Measures to reduce emissions of dust and particulate matter from key sources including the haul roads, tailings storage facility and open pit to minimize air quality and health effects;
- Conduct piling activities only during the daytime period and select best achievable technology for mine fleet equipment to minimize noise;
- Manage and revise the controllable blast design parameters on an ongoing basis to minimize noise;
- Improvements to boat ramp and day use facilities at Jacko Lake;
- Measures to record, date, retain, catalogue and share information about heritage sites, including archaeological sites, early settlement sites and Indigenous heritage sites; and
- Measures outlined above to mitigate effects to water quality, fish and fish habitat, noise, wildlife and vegetation would also mitigate some effects to current use of lands and resources for traditional purposes.

Overall, the Agency and EAO conclude that the Ajax Mine Project is likely to cause significant adverse effects to heritage and to the current use of lands and resources for traditional purposes by aboriginal persons. The Agency and EAO also conclude that the effects of the Ajax Mine Project in combination with the effects of past and present activities is likely to cause significant cumulative effects to heritage and current use of lands and resources for traditional purposes. For other valued components examined under the former Act and BC *Environmental Assessment Act,* the Report concludes that the Ajax Mine Project is not likely to cause significant adverse effects. These conclusions were reached taking into account the implementation of mitigation measures and the EAO's proposed Environmental Assessment Certificate conditions that would become legally-binding in the event an Environmental Assessment Certificate is issued.

If the Ajax Mine Project proceeds, a follow-up program would be required to verify the accuracy of environmental assessment predictions and to determine the effectiveness of proposed mitigation measures. The Agency recommends that the follow-up program include monitoring of effects to surface water and groundwater, fish and fish habitat, vegetation, wildlife, air quality, human health, current use of lands and resources for traditional purposes, and heritage. The EAO has proposed a number of Environmental Assessment Certificate conditions that would require KGHM Ajax Mining Inc. to develop and implement management and monitoring plans for key adverse effects.

The Crown has a common law duty to consult Indigenous groups, and where appropriate accommodate, when it contemplates conduct that might adversely affect asserted or established Aboriginal or Treaty rights. This Report discusses the Agency and EAO's assessment of the Ajax Mine Project's potential impacts to the Aboriginal Interests of SSN, Lower Nicola Indian Band, Ashcroft Indian Band, Whispering Pines/Clinton Indian Band, and the Agency's views on the impacts to Métis Nation British Columbia.

The Agency and EAO conclude that the Ajax Mine Project would result in adverse impacts on Aboriginal Interests, with the most serious potential impacts on SSN's asserted Aboriginal right to practice cultural and spiritual customs, ceremonies, and traditions in the area known as *Pípsell*, which overlaps the mine site.

The joint federal Comprehensive Study/provincial Assessment Report, along with proposed Environmental Assessment Certificate conditions, is subject to a public comment period. The joint federal Comprehensive Study/provincial Assessment Report and supporting materials, including a summary of comments received on the report, will be provided to federal and provincial ministers to inform their respective decisions on the Ajax Mine Project.

Taking into consideration the joint federal Comprehensive Study/provincial Assessment Report and any comments received, the federal Minister of Environment and Climate Change will decide whether or not, taking into account the implementation of mitigation measures, the Ajax Mine Project is likely to cause significant adverse effects. The environmental assessment will then be referred back to the responsible authorities, Fisheries and Oceans Canada and Natural Resources Canada, for an appropriate course of action in accordance with section 37 of the former Act.

Similarly, following public consultation on the joint federal Comprehensive Study/provincial Assessment Report, the provincial Minister of Environment and Climate Change Strategy and Minister of Energy, Mines and Petroleum Resources will consider the report and other accompanying materials, as well as any other matters that they consider relevant to the public interest, in making their decision on whether to issue or refuse to issue an Environmental Assessment Certificate, or to order that further assessment be carried out.

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LIST OF ACRONYMS

the Agency	Canadian Environmental Assessment Agency
Ajax	proposed Ajax Mine Project
DFO	Fisheries and Oceans Canada
EA	environmental assessment
the EAO	Environmental Assessment Office
ECCC	Environment and Climate Change Canada
EIS/Application	Environmental Impact Statement/Application for an Environmental Assessment Certificate
EISG/AIR	Environmental Impact Statement Guidelines/Application Information Requirements
MFLNR	Ministry of Forests, Lands and Natural Resource Operations
former Act	*Canadian Environmental Assessment Act, S.C. 1992, c.37*
HC	Health Canada
HHRA	Human Health Risk Assessment
KAM	KGHM Ajax Mining Inc.
MIRR	Ministry of Indigenous Relations and Reconciliation
MEMPR	Ministry of Energy, Mines and Petroleum Resources
MMPO	Major Mine Permitting Office
MOE	Ministry of Environment
MOTI	Ministry of Transportation and Infrastructure
NRCan	Natural Resources Canada
the Report	federal Comprehensive Study Report/provincial Assessment Report
TLU	Traditional land use
SSN	Stk'emlupsemc te Secwépemc Nation
TNRD	Thompson-Nicola Regional District
TMX	Trans Mountain Expansion Project
working group	joint Agency/EAO working group

Part A – Introduction and Background

1 Introduction

1.1 PURPOSE OF THE REPORT

KGHM Ajax Mining Inc. (KAM) proposes to develop the Ajax Mine Project (Ajax) near Kamloops, British Columbia (BC). Ajax was subject to review under both federal and provincial environmental assessment (EA) legislation, and a cooperative EA was carried out by the Canadian Environmental Assessment Agency (the Agency) and the British Columbia Environmental Assessment Office (EAO). The Agency and EAO worked together to produce this joint federal Comprehensive Study Report / provincial Assessment Report (the Report) to meet federal and provincial EA requirements. The Report presents the information and analysis that the Agency and EAO each considered in determining whether, taking into account the implementation of mitigation measures, Ajax is likely to cause significant adverse effects.

The analysis and findings in the Report are based on the Agency's and EAO's review of KAM's Environmental Impact Statement / Application for an Environmental Assessment Certificate (EIS/Application) filed January 15, 2016, and additional documents filed during the EA. The Report also considers comments from Indigenous groups and the public and advice provided by federal, provincial and local government experts.

The federal Minister of Environment and Climate Change will, after considering the Report and comments received in relation to the Report, decide whether, taking into account the implementation of mitigation measures, Ajax is likely to cause significant adverse environmental effects. The EA will then be referred back to the responsible authorities, Fisheries and Oceans Canada (DFO) and Natural Resources Canada (NRCan), for an appropriate course of action in accordance with section 37 of the former Act.

The BC Minister of Environment and BC Minister of Energy, Mines and Petroleum Resources will consider the Report, as well as any other matters that they consider relevant to the public interest, in making their decision on whether to issue or refuse to issue a provincial Environmental Assessment Certificate (EA Certificate), or to order that further assessment be carried out.

The Report:

- Describes Ajax and the EA process undertaken, including consultation with Indigenous groups and the public;
- Gives an overview of the valued components assessed in the EA and identifies potential adverse environmental, economic, social, heritage, and health effects associated with those valued components;
- Provides the key findings from the EIS/Application, including residual adverse effects and proposed mitigation measures;
- Describes the views of government agencies, Indigenous groups and the public on KAM's findings, the key issues that emerged during the EA, and the status of those issues;
- Outlines the analysis and conclusions of the Agency and EAO relating to the significance of any residual adverse effects;

- Provides a rationale for the provincial conditions that are proposed to address potential effects should KAM be granted an EA Certificate;
- Describes relevant linkages to subsequent permitting or other initiatives; and,
- Provides a technical foundation for the conclusions of the Agency and EAO relating to impacts to Aboriginal Interests.[1]

In preparing the Report, the Agency and EAO considered the following information:

- EIS/Application and subsequent technical memorandums;
- KAM's First Nations and Public Consultation Reports;
- Technical advice, issues and concerns provided by the joint Agency/EAO working group (working group), which includes representatives of Indigenous groups, federal and provincial government departments, Thompson-Nicola Regional District (TNRD), and the City of Kamloops, and KAM's responses to those issues;
- Issues and concerns raised by the public and representatives of Indigenous groups not part of the working group, and KAM's responses to those issues; and
- Information provided through Stk'emlupsemc te Secwépemc Nation's (SSN) Assessment Process for Ajax.

1.2 ENVIRONMENTAL ASSESSMENT PROCESS

The Governments of Canada and British Columbia conducted the EA cooperatively in accordance with the principles of the *Canada-BC Agreement on Environmental Assessment Cooperation (2004).* Separate federal and provincial EA decisions will be made at a Ministerial level. This section outlines the federal and provincial EA requirements, the valued components assessed, and the Aboriginal and public consultation processes conducted jointly by the Agency and EAO.

1.2.1 FEDERAL ENVIRONMENTAL ASSESSMENT

Ajax is subject to an EA pursuant to the *Canadian Environmental Assessment Act, S.C. 1992, c.37* (former Act). The former Act applied to federal authorities that contemplated certain actions or decisions that would enable a project to proceed in whole or in part. DFO and NRCan may issue authorizations, permits or approvals in relation to Ajax pursuant to the *Fisheries Act* and *Explosives Act*, respectively.

The *Canadian Environmental Assessment Act, 2012* (CEAA 2012) came into force on July 6, 2012, replacing the former Act. In accordance with the transition provisions of CEAA 2012, the comprehensive study for Ajax, which commenced in May 2011, is being completed under the former Act.

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[1] Asserted or established Aboriginal rights, including title

Ajax is subject to a comprehensive study type EA under the former Act pursuant to sections 16(a), 16(b) and 16(c) of the *Comprehensive Study List Regulations*, as it meets the following thresholds:

- 16(a) The proposed construction, decommissioning or abandonment of a metal mine, other than a gold mine, with an ore production capacity of 3 000 t/d or more;
- 16(b) The proposed construction, decommissioning or abandonment of a metal mill with an ore input capacity of 4 000 t/d or more; and
- 16(c) The proposed construction, decommissioning or abandonment of a gold mine, other than a placer mine, with an ore production capacity of 600 t/d or more.

The Agency considered the following factors as part of the comprehensive study pursuant to subsections 16(1) and 16(2) of the former Act:

- Environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- Significance of the environmental effects referenced above;
- Comments from the public that are received in accordance with the former Act and its regulations;
- Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;
- Purpose of the project;
- Alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;
- Need for, and the requirements of, any follow-up program in respect of the project; and
- Capacity of renewable resources that are likely to be significantly affected by the project to meet present and future needs.

The *Species at Risk Act* requires responsible authorities to identify adverse effects of projects on listed species and their critical habitats, and to ensure that measures are taken to avoid or lessen those effects and to monitor them. The EA considered effects on species listed on Schedule 1 under the *Species at Risk Act*. It also considered impacts on species listed by the Committee on the Status of Endangered Wildlife in Canada.

1.2.2 PROVINCIAL ENVIRONMENTAL ASSESSMENT

Ajax is reviewable under BC's *Environmental Assessment Act* (provincial Act), pursuant to Part 4 of the *Reviewable Projects Regulation*, because it would have a production capacity greater than or equal to 75,000 tonnes per annum of mineral ore.

In conducting the EA, the EAO considered the potential environmental, economic, social, heritage, and health effects, including cumulative effects, of Ajax as required under the provincial Act.

Additional information on the provincial EA process is available on the EAO's website: https://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_home_362.html.

Table 1 outlines important process milestones reached during the provincial EA. Important public consultation activities are summarized in the Public Consultation Overview below (section 1.2.7).

Table 1: Key Process Milestones in the Cooperative EA

Date	Milestone	Description
EISG/AIR Development		
February 25, 2011	EAO section 10 order	The EAO designated Ajax as a reviewable project and commenced the provincial EA process.
May 31, 2011	Agency Notice of Commencement	Public notification of the requirement for a federal EA and commencement of a comprehensive study.
June 3, 2011	EAO section 11 order	The EAO issued an initial order under section11 requiring a public comment period on the project description.
January 11, 2012	EAO section 11 order	The EAO issued an order under section11 of the provincial Act, which set out the scope, procedures and methods for the EA.
June 3, 2013	Environmental Impact Statement Guidelines/Application Information Requirements (EISG/AIR) issued	Outlines the information that must be collected, analyzed and included as part of the KAM's Application for an EA Certificate.
May 29, 2014	KAM Project Modifications	KAM announced changes to the location and layout of Ajax, requiring revisions of the EISG/AIR.
July 23, 2015	EAO section 13 order	The EAO issued an Order under section13 which modified the scope of the assessment.
July 23, 2015	Final EISG/AIR	The Agency and EAO issued the final EISG/AIR to KAM.
EIS/Application Development		
September 14, 2015	EIS/Application Submitted	KAM submitted its EIS/Application for evaluation by the Agency and EAO.
October 9, 2015	Extension request for EIS/Application evaluation period	The EAO granted KAM's request for a 38-day extension to the EIS/Application evaluation period, allowing SSN additional time for comment and KAM an opportunity to prepare supplemental information on the assessment of tailings storage facility alternatives.
November 20, 2015	EIS/Application evaluation and Indigenous consultation activities	The EAO confirmed that the EIS/Application met the requirements of the EISG/AIR. The EAO also provided its assessment of the past/present public and Indigenous consultation activities.
EIS/Application Review		
January 18, 2016	Commencement of EIS/Application Review	The EAO's 180-day EIS/Application Review period began.
May 4, 2016	EA temporarily	At KAM's request, the EAO suspended the review timeline

Date	Milestone	Description
	suspended	pending KAM's completed responses to public, Indigenous groups, and working group comments on the EIS/Application.
March 29, 2017	EA suspension lifted	The EAO lifted the suspension and extended the provincial review by 110 days, in order to align the provincial and the federal review timelines and to add a public comment period on the Report.
August 8, 2017	Report posted	EAO and Agency post their announcements and the Report, and notification of the start of public comment period.

1.2.3 FEDERAL AND PROVINCIAL COORDINATION

The Agency and EAO conducted a cooperative EA of Ajax, commencing in 2011. Consistent with a cooperative review process, the Agency and EAO:

- Coordinated consultation with Indigenous groups;
- Conducted joint public consultation periods;
- Co-chaired a working group composed of representatives of Indigenous groups, federal and provincial government departments, the TNRD, and the City of Kamloops;
- Issued a joint EISG/AIR that outlined the information required for the EIS/Application; and
- Reviewed a single EIS/Application intended to address both federal and provincial requirements.

In March 2017, the Agency and EAO agreed to jointly draft the Report to ensure both levels of government considered the same information and to improve efficiency for participants in their review of the Report. The Report provides the information required in both the provincial Act and the former Act.

1.2.4 VALUED COMPONENTS AND ASSESSMENT BOUNDARIES

For the purposes of evaluating the potential for significant adverse environmental effects, the EA focused on aspects of the natural and human environment with particular value or importance that are likely to be impacted by Ajax (Table 2). These aspects are referred to as valued components. The valued components were identified based on scientific, ecological, economic, social, cultural, archaeological, historical or other importance, and in consideration of feedback from the public and Indigenous groups, and legislative requirements.

In some cases, a valued component was selected because it is a pathway or contributor of effects to another component. The following "pathway valued components" were identified: air quality, groundwater quality, and noise and vibration. Some valued components are both directly impacted by Ajax ("receptor valued component") and a pathway valued component. Examples include: surface water quality, surface water quantity, and groundwater quantity. The Agency and EAO's determination of significance of residual adverse effects was done for receptor valued components.

To focus the Report, the Agency and EAO grouped the valued components identified by the EISG/AIR into the nineteen valued components listed in Table 2.

Table 2: Valued Components Assessed by the Agency and EAO (*) or the EAO Only (^)

Valued Component in EIS/Application	Valued Component Examined in the Report (Receptor or Pathway VC)	Rationale for Valued Component Selection
Environment		
Greenhouse Gas Management	Greenhouse Gases* (Pathway VC)	Ajax activities would emit greenhouse gases (GHGs) and contribute to atmospheric GHG levels. Multiple parties, including government agencies, Indigenous groups and the public, identified concerns with GHG emissions contributing to climate change and climate change resulting in exacerbation of effects from Ajax.
Geology, Landforms and Soils	Vegetation* (Receptor VC)	Vegetation, including wetlands, grasslands and rare plants, was selected due to its potential to be affected by Ajax, its ecological importance, and its value to Indigenous groups.
Surface Water Quality	Surface Water Quality and Quantity* (Receptor and Pathway VC)	Surface water quality and quantity were selected since project components and activities may affect surface water quality and quantity both of which have ecological importance and contribute to effects on other valued components: fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, human health, land and resource use, and Aboriginal Interests.
Surface Water Quantity		
Groundwater Quality	Groundwater Quality (Pathway VC) and Quantity (Receptor and Pathway VC)*	Groundwater quality was selected because project components and activities may affect groundwater quality, which contributes to effects to other valued components: surface water quality and human health. Groundwater quantity was selected because changes in groundwater elevations and flows affect surface water, land and resource use, and Aboriginal Interests.
Groundwater Quantity		
Fish Populations and Fish Habitat	Fish and Fish Habitat* (Receptor VC)	Fish and fish habitat was selected due to its potential to be affected by Ajax, and its importance to ecosystem health and recreational and Aboriginal fisheries.
Rare Plants	Vegetation* (Receptor VC)	Vegetation, including wetlands, grasslands, and rare plants, was selected due to its potential to be affected by Ajax, its ecological importance, and its value to Indigenous groups.
Rare and Sensitive Ecological Communities		
Grasslands		
Terrestrial	Wildlife*	Wildlife species, including provincially and/or federally

Valued Component in EIS/Application	Valued Component Examined in the Report (Receptor or Pathway VC)	Rationale for Valued Component Selection
invertebrates Amphibians Reptiles Migratory Birds Raptors Non-migratory game birds Mammals	(Receptor VC)	listed terrestrial invertebrates, amphibians, reptiles, migratory birds, raptors, non-migratory gamebirds, and mammals, were selected due to their potential to be affected by Ajax, ecological importance, and value to Indigenous groups.
Current Use of Land and Resources for Traditional Purposes	Current Use of Land and Resources for Traditional Purposes* (Receptor VC)	Ajax would result in changes to the environment such as changes to fish and fish habitat and changes to wildlife. Effects on fishing, hunting, gathering, and cultural/ceremonial uses by aboriginal people were assessed as a requirement under the former Act.
Health		
Air Quality	Air Quality* (Pathway VC)	Project components and activities may cause changes in concentrations of criteria air contaminants which can contribute effects to other valued components: surface water quality, vegetation, human health, property values, and Aboriginal Interests.
Domestic Water Quality Country Foods Human Health	Human Health* (Receptor VC)	Human health was selected due the potential for Ajax to result in health effects, and its importance to residents of Kamloops living in close proximity to Ajax.
Noise and Vibration	Noise and Vibration* (Pathway VC)	Changes in noise and vibration conditions can affect ecological, social, economic, and health values. Noise and vibration effects contribute to effects to other valued components: wildlife, land and resource use, fish and fish habitat, current use of lands and resources for traditional purposes, and property values.
Healthy Living and Health Education Community Health and Well-being	Community Wellbeing^ (Receptor VC)	Community wellbeing, including access to healthcare, visual quality, and dark sky, was selected because project effects such as worker in-migration and visual quality changes from the mine have the potential to impact the wellbeing of local and regional residents.
Social		
Infrastructure, Public Facilities and	Accommodation, Infrastructure, Public	Accommodation was added to the infrastructure, public facilities and services valued component to reflect concerns

Valued Component in EIS/Application	Valued Component Examined in the Report (Receptor or Pathway VC)	Rationale for Valued Component Selection
Services	Facilities and Services^ (Receptor VC)	about affordable housing in Kamloops. Infrastructure, public facilities and services was selected due to concerns about project impacts to the City's and TNRD's roads, waste services, policing, and fire services associated with construction and operations.
Dark Sky	Community Well-being^ (Receptor VC)	See rationale for community wellbeing above.
Visual Impact and Aesthetic Features		
Land and Resource Use	Land and Resource Use^ (Receptor VC)	Land and resource use was selected due to concerns about future housing development in proximity to the mine site. Land and resource use also assesses potential impacts to irrigation and ranching practices.
Outdoor Recreation	Recreation^ (Receptor VC)	The recreation valued component reflects the importance of recreation to nearby residents, in particular, the importance of Jacko Lake to local and regional anglers.
Economic		
Economic Growth	Economic Effects^ (Receptor VC)	Economic effects includes the economic valued components assessed by KAM and reflects the public's concerns regarding the potential for Ajax construction and operations to result in unintended adverse economic effects, such as increased labour competition, to the local economy.
Labour Force, Employment and Training		
Income		
Business		
Economic Diversification		
Property Values	Property Values^ (Receptor VC)	The property values valued component reflects the public's concerns about the potential monetary loss to Kamloops housing values as a result of Ajax activities.
Heritage		
Archeological Sites	Heritage* (Receptor VC)	Heritage was selected as a valued component due to its importance to Indigenous groups, members of the public, and government organizations, and the potential for interactions between heritage resources and Ajax. Heritage
Aboriginal and Non-Aboriginal Heritage Sites		

Valued Component in EIS/Application	Valued Component Examined in the Report (Receptor or Pathway VC)	Rationale for Valued Component Selection
		value is defined as the aesthetic, historic, scientific, cultural, social or spiritual importance or significance for past, present or future generations (Parks Canada, 2013).[2] The value of heritage originates from its association with one or more important aspects of human history or culture; historical, archaeological, paleontological or architectural significance; and association with a particular group's practices, traditions or customs.

** Indicates joint CEAA and EAO assessment, ^ Indicates EAO only assessment*

Assessment boundaries define the maximum spatial and temporal limits within which Ajax is expected to interact with the valued components. Local study areas were used to assess effects on each valued component and regional study areas were used to assess cumulative effects. The study areas and temporal boundaries were characterized as follows:

- A local study area is the project footprint and surrounding area within which there is a reasonable potential for effects due to an interaction with a project component or activities;
- A regional study area includes the local study area and areas within which the project's environmental effects may overlap or act cumulatively with the environmental effects of other projects or activities; and
- Temporal boundaries were defined based on the project phases (i.e., construction, operation, decommissioning and closure, and post-closure).

1.2.5 GOVERNMENT AGENCY CONSULTATION

The Agency and EAO established a working group, made up of federal, provincial, local government, and Indigenous groups' staff or representatives, to provide technical advice during the EA. The Agency and EAO sought involvement from agencies with relevant mandates and expertise. A list of working group member agencies is included as Appendix F.

The Agency and EAO requested and considered advice from the working group at various points in the EA in order to understand and assess potential adverse effects associated with Ajax. Specifically, working group members were asked to advise on:

- Key EA documents, including the EISG/AIR, EIS/Application, draft Report, and proposed conditions;

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[2] Cultural Resource Management Policy, 2013

- Matters within their mandates and areas of expertise; and
- Technical issues raised during consultation with Indigenous groups and/or the public.

The Agency and EAO reviewed and assessed the adequacy of KAM's responses to working group members' comments and met with the working group to discuss outstanding issues and concerns throughout the EA. The Agency and EAO sought working group input on a draft version of the Report and considered all comments in preparing the final Report.

1.2.6 ABORIGINAL CONSULTATION OVERVIEW

In Canada, government has a duty to consult Indigenous groups and, where appropriate, to accommodate, when it has knowledge that its proposed conduct might adversely impact an asserted or established Aboriginal or Treaty right. As the federal Crown Consultation Coordinator, the Agency coordinated consultation activities on behalf of the responsible federal authorities.

During the Ajax EA, the Agency and the EAO endeavoured to conduct joint consultation activities to the extent possible. This included sharing correspondence, participating in joint meetings with Indigenous groups, ensuring that Indigenous groups were provided with responses to comments and issues raised throughout the process, and providing Indigenous groups with a joint consultation report for review and comment. Both the Agency and the EAO made funding available to Indigenous groups to assist their participation in the EA.

The Agency and EAO each consulted the following Indigenous groups in relation to Ajax: SSN (including Skeetchestn Indian Band and Tk'emlúps te Secwépemc); Ashcroft Indian Band (Ashcroft); and Lower Nicola Indian Band (Lower Nicola). The Agency also included Whispering Pines/Clinton Indian Band (Whispering Pines/Clinton) and Métis Nation British Columbia (MNBC) as Indigenous groups to be consulted. The EAO identified Whispering Pines/Clinton as an Indigenous group to be notified at EA milestones.

The Agency's and EAO's consultation with SSN evolved over the course of the EA, particularly from 2015 onward. During this time, SSN and the EAO developed and implemented the Ajax EA Collaboration Plan. The purpose of the plan was to support informed decision making, to ensure that SSN had direct input into the provincial decision-making process and to ensure that SSN's input was adequately considered in the EA. The plan also embedded the SSN's own assessment process in the provincial EA process. The Agency developed and implemented a Joint Consultation Approach with SSN, and this document was revised during the EA process based on SSN's feedback.

Additional information regarding consultation with Indigenous groups can be found in Part C of this Report.

1.2.7 PUBLIC CONSULTATION OVERVIEW

The Agency, the EAO, and KAM all carried out public consultation activities during the EA. The EAO set out the provincial requirements for public consultation in the section 11 orders issued on June 3, 2011, and January 11, 2012.

The former Act requires that the public be provided with a minimum of three formal participation opportunities during a comprehensive study. The provincial Act requires at least one formal public comment period during the EA. For Ajax, the five coordinated public consultation periods that were provided by the Agency and EAO are listed in Table 3.

Table 3: Joint Federal-Provincial Public Consultation Opportunities

Document/Subject of Consultation	Consultation Activity	Date
Ajax Background Information	Public comment period	June 8, 2011 to July 11, 2011
	Information sessions	June 16, 2011
Draft EISG/AIR and summary EISG/AIR	Public comment period	January 11, 2012 to March 12, 2012
	Information sessions	February 6 and 7, 2012
Revised EISG/AIR and Summary of revised EISG/AIR	Public comment period	November 18, 2014 to December 18, 2014
	Information sessions	November 25 and 26, 2014
KAM's EIS Report and federal EIS Report Summary and provincial Application review	Public comment period	January 26, 2016 to April 11, 2016
	Agency/EAO/KAM technical presentations	February 16 and 17, 2016
	Agency/EAO/KAM information sessions	March 15 and 16, 2016
Joint Comprehensive Study / Assessment Report	Public comment period	Commencing August 8, 2017

The Agency administers a Participant Funding Program, which supports individuals, non-profit organizations, and Indigenous groups interested in participating in federal EAs. To assist participation of the public in the Ajax EA, the Agency provided funding to the following groups in 2011: $15,915 to the Sierra Club BC; $18,700 to the Grasslands Conservation Council of British Columbia, on behalf of the Kamloops Naturalist Club and the Kamloops District Fish and Game Association; $11,950 to the Kamloops Area Preservation Association; and, $7,425 to a member of the public.

As a requirement of the procedural order issued to KAM, the EAO required KAM to submit a plan for EA public consultation that was satisfactory to the EAO, to report on their activities in the EIS/Application, and to provide a public consultation report within a specified timeframe after the end of the EIS/Application review public comment period. KAM's public consultation plan described its consultation objectives and supporting activities. KAM undertook public engagement activities that included providing plain language and technical information about Ajax to the public and stakeholder groups, Indigenous groups, and government agencies; seeking input from potentially affected stakeholders; and responding to comments and questions received. Through public engagement during the course of the EA, the Agency and EAO consider KAM to have adequately responded to issues raised by the public.

KAM's public consultation plans and reports are posted on the EAO's website.

The EAO also established a Community Advisory Group[3] of interested local groups and potentially-affected stakeholder organizations that met periodically throughout the EA. According to the terms of reference for this group, the objectives were to:

- Provide a forum for meaningful dialogue and input into the EA of Ajax;
- Obtain and provide rigorous review of information regarding Ajax;
- Provide input into and promote effective communication and engagement between government and specific interest groups and the general public regarding Ajax; and
- Foster collective learning about EA and Ajax.

Over the course of the EA and in addition to the opportunities for general public input provided during the EIS/Application review, the Community Advisory Group met formally with the EAO on 16 occasions between 2012 and 2016, with the Agency observing most of these meetings. The activities and opportunities afforded to the Community Advisory Group included:

- Collaboratively developing the Community Advisory Group terms of reference with the EAO;
- Providing direct input on KAM's public consultation plan to the EAO;
- Direct input on the EISG/AIR for consideration by the EAO;
- Opportunities to review preliminary drafts of the EISG/AIR and issues tracking table results;
- Regular opportunities to pose questions to the EAO, and at times the Agency, regarding the EA process including questions about changes to the EA process as a result of project modifications by KAM;
- Opportunities for project site visits with the EAO and KAM staff;
- Opportunity to present a single comprehensive submission of comments as a group, and receive a response from KAM; and
- Opportunities to meet directly with KAM, including KAM's technical experts, and seek clarification regarding the information in the EIS/Application, to inform Community Advisory Group member submissions during the public comment period.

The public provided substantial input at all stages of the EA. Key issues raised by the public helped inform the Agency and EAO's assessment of Ajax, including requests for supplemental information during the EA, the completion of this Report, and the development of the proposed provincial EA Certificate conditions for Ajax. Input from the public that overlapped with issues raised by the working group is further discussed in the relevant valued component sections of the Report.

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[3] Member organizations of the Community Advisory Group include: Aberdeen Community Association Aberdeen Highlands Development Corporation; BC Cattlemen's Association; Coalition for the Preservation of East Kamloops; Ducks Unlimited; Grasslands Conservation Council of British Columbia; Kamloops & District Fish & Game Association; Kamloops Area Preservation Association; Kamloops Astronomical Society; Kamloops Exploration Group; Kamloops Fly Fishers' Association; Kamloops Naturalist Club; Kamloops Physicians for a Healthy Environment; Kamloops Stockmen's Association; Lac Le Jeune Conservation Association; Pineview Community Group; Thompson Institute of Environmental Studies; Thompson Watershed Coalition; and Thompson Rivers University Faculty Association Human Rights Committee.

The key issues raised by the public regarding the EIS/Application during the public comment periods included the following:

- **Project location/siting** – Concerns with the proximity of Ajax to residential neighbourhoods;
- **Public safety** – Concerns about accidents and malfunctions and risks to public safety;
- **Tailings storage facility** – Concerns about a potential breach of the tailings storage facility;
- **Air quality** – Concerns about emissions from Ajax, KAM's ability to sufficiently mitigate dust, and potential effects on the local airshed and human health;
- **Water quality –** Concerns about mine related emission impacts on surface and groundwater quality in consideration of human health, livestock health, wildlife health, and the consumption of country foods;
- **Water quantity** – Concerns about project water demands, withdrawal from Kamloops Lake, and impacts related to climate change;
- **Wildlife and grasslands** – Concerns that Ajax would alter or destroy sensitive grassland habitat and rare plant species, and adversely affect wildlife in the vicinity of the project;
- **Community health and wellbeing** – Concerns that Ajax would increase pressure on the health care services and that health care providers would leave Kamloops;
- **Property values** – Concerns that potential impact from noise, vibration, dust, and impacts to visual quality (or the perception of impacts) would lower property values in the neighbourhoods near the mine site;
- **Tourism, recreation and Kamloops 'tournament capital' brand** – Concerns that the presence of an industrial facility above Kamloops would have negative effects on tourism, recreation and the ability of the City to attract events under the tournament capital brand;
- **Angling on Jacko Lake** – Concerns that noise, vibration, visual quality impacts and access restrictions would substantially alter the Jacko Lake angling experience;
- **Government oversight, regulation, compliance and enforcement** – Concerns that there is insufficient government oversight and regulation of mines in BC. Concern that there would be a lack of compliance by KAM and limited enforcement capability by the regulators to ensure compliance;
- **EA process** – Comments and questions related to the rigour, transparency and neutrality of the EA process; and
- **Public consultation process** – Concerns that the process was not responsive to public concerns and that comments would not be adequately considered by Ministers.

1.2.8 CITY OF KAMLOOPS CONSULTATION

In addition to participation through the technical working group, the City of Kamloops Council undertook its own series of public engagement activities during the EA, including special council meetings and presentations by an EA consulting firm (SLR Consulting Ltd.) retained by the City to conduct a review of the EIS/Application.

The EAO and the City of Kamloops staff maintained regular communication to ensure that public consultation undertaken through their respective processes was coordinated to the extent necessary.

On July 17, 2017, the City of Kamloops Council voted to oppose Ajax. On the same day, City of Kamloops announced that they have agreed in principle to a community benefits agreement in which KAM would provide $3.8 million per year to the City of Kamloops throughout the life of the project.

In addition to the City of Kamloop's input provided through the working group, the City of Kamloops highlighted several areas of concern regarding the impacts of Ajax, which included:

- Air quality effects, mitigation effectiveness and impacts to human health;
- Increased pressure on municipal road infrastructure and other municipal services, traffic volumes, affordable housing demand, healthcare services, and labour force competition;
- Effects to terrestrial and aquatic environments, and water quality;
- Uncertainty regarding the economic benefit impacts to the City;
- Effects on property values, in consideration of changes to air quality, noise and dark sky;
- Impacts to availability of housing tourist accommodation, with consequent economic impacts to the City;
- Uncertainties associated with the implementation of monitoring and management actions to address social and economic effects; and
- Risks of accidents and malfunctions, including from the tailings storage facility.

Information provided by the City of Kamloops was considered in this Report and proposed EA Certificate conditions.

1.3 AUTHORIZATIONS

In addition to the federal and provincial EA approvals, Ajax would need various permits and authorizations from federal, provincial, and local governments.

1.3.1 FEDERAL REGULATORY ENVIRONMENT

Key federal permits and authorizations required to enable Ajax to be carried out:

- *Fisheries Act* (R.S.C., 1985) authorizations under section 35, section 36, section 38(4), section 38(5), and section 38(6); and
- *Explosives Act* (R.S.C., 1985) licence.

1.3.2 PROVINCIAL REGULATORY ENVIRONMENT

The primary regulators for the construction and operation of mines in BC are the Ministry of Energy, Mines and Petroleum Resources (MEMPR), under the *Mines Act*, and the BC Ministry of Environment (MOE), under the *Environmental Management Act*. Should an EA Certificate be issued, extensive permits would be required before Ajax could proceed. These include authorizations under each of the following acts:

- MEMPR required permits and leases under the *Mines Act* and the *Mineral Tenure Act*:
    - Mines Act Permit (under the *Mines Act*); and
    - Mining Lease (under the *Mineral Tenure Act*).
- MOE required permits under the *Environmental Management Act*:
    - Waste discharge permits (effluent and emissions);

    - Hazardous waste registration; and
    - Refuse discharge permit.
- Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNR) required licences under the *Water Sustainability Act*:
    - Water licence for consumptive use of water;
    - Multiple water licences for dams on Jacko Lake; and
    - Water licence for tailing storage facility.
- MFLNR required licences or permits under the *Land Act*, the *Forest Act*, and the *Heritage Conservation Act*:
    - One licence of occupation, two interim licences of occupation, and a grazing lease amendment (all under the *Land Act*);
    - Two occupant licences to cut (under the *Forest Act*); and
    - Site alteration permits (under the *Heritage Act*).
- Ministry of Transportation and Infrastructure (MOTI) required approvals under the *Transportation Act*:
    - Three access/controlled area approvals; and
    - Two approvals to discontinue, close, and acquire the land in a public road.
- Interior Health Authority (IHA) required permits under the *Drinking Water Protection Act*:
    - Construction Permit;
    - Operating Permit; and
    - Holding Tank Permit (under the *Public Health Act*).
- Agricultural Land Commission required amendments under the *Agricultural Land Commission Act*:
    - Two amendments to temporary change to non-agricultural use;
    - Two amendments for transportation and utility use in the Agricultural Land Reserve; and
    - Permanent exclusion of the open pit area from the Agricultural Land Reserve.

Additional permits, registrations, notices, and notifications are required prior to construction. The Major Mine Permitting Office (MMPO) of MEMPR coordinates the authorization process for large scale mines in BC.

1.3.3 LOCAL GOVERNMENT AUTHORIZATIONS

Should an EA Certificate be issued, KAM would need to apply for the following local government authorizations:

- TNRD required permits:
    - Building permits for Inks Lake Park and Ride and the Explosives Manufacturing Facility; and
    - Demolition permits for residential structures on the Ajax site.
- City of Kamloops required permits:
    - Two right of way road usage permits for road access to mine site and 230kV powerline; and
    - Site specific rezoning approval and building permit for explosives manufacturing facility.

For a complete list of the permits and authorizations required for Ajax, see the EIS/Application (section 2.8.2), posted on the EAO's website.

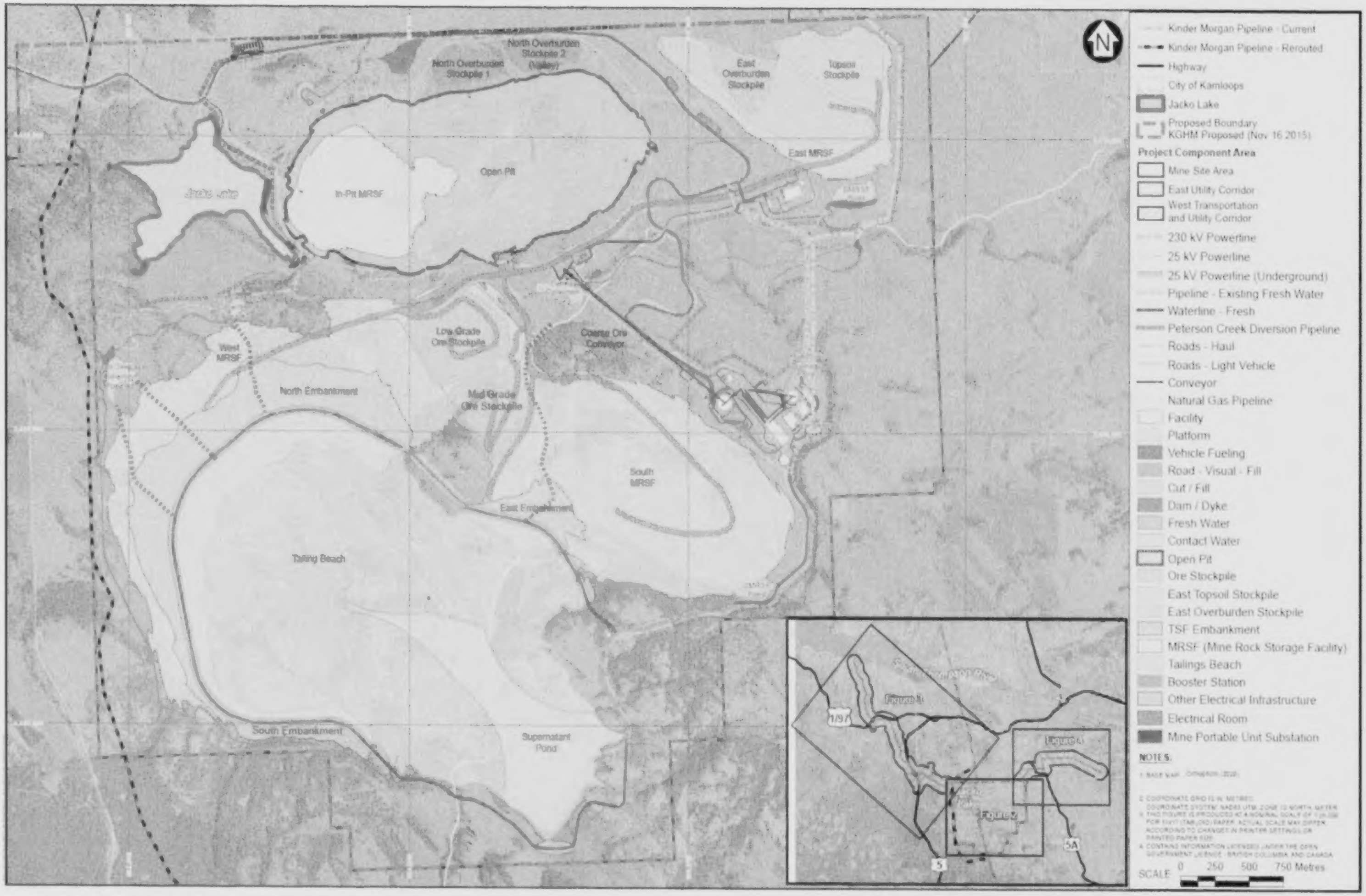
1.4 PROJECT OVERVIEW

The proponent for Ajax is KAM, a joint venture company between KGHM Polska Miedź S.A. and Abacus Mining and Exploration Corp.

1.4.1 PROJECT PROPONENT, DESCRIPTION AND LOCATION

KAM proposes to construct, operate and decommission an open-pit copper and gold mine and ore processing facility located adjacent to the southern limits of the City of Kamloops, which is in the TNRD in south-central BC (see Figure 1). The Ajax footprint would be approximately 1,700 hectares and operate for an estimated 23 years at a mining rate of 65,000 tonnes (t) of ore per day. Over the life of Ajax, the mining process would produce 140 million pounds of copper and 130,000 ounces of gold in concentrate annually, which would be transported by truck to the Port of Vancouver for distribution to market.

Figure 1: Ajax Location and General Arrangement


N
North Overburden Stockpile 1
North Overburden Stockpile 2 (Valley)
East Overburden Stockpile
Topsoil Stockpile
East MRSF
Jacko Lake
In-Pit MRSF
Open Pit
Low Grade Ore Stockpile
Coarse Ore Conveyor
West MRSF
North Embankment
Mid Grade Ore Stockpile
South MRSF
East Embankment
Tailing Beach
South Embankment
Supernatant Pond
Figure 3
Figure 4
Figure 2
1/97
5
5A
Kinder Morgan Pipeline - Current
Kinder Morgan Pipeline - Rerouted
Highway
City of Kamloops
Jacko Lake
Proposed Boundary KGHM Proposed (Nov 16 2015)
Project Component Area
Mine Site Area
East Utility Corridor
West Transportation and Utility Corridor
230 kV Powerline
25 kV Powerline
25 kV Powerline (Underground)
Pipeline - Existing Fresh Water
Waterline - Fresh
Peterson Creek Diversion Pipeline
Roads - Haul
Roads - Light Vehicle
Conveyor
Natural Gas Pipeline
Facility
Platform
Vehicle Fueling
Road - Visual - Fill
Cut / Fill
Dam / Dyke
Fresh Water
Contact Water
Open Pit
Ore Stockpile
East Topsoil Stockpile
East Overburden Stockpile
TSF Embankment
MRSF (Mine Rock Storage Facility)
Tailings Beach
Booster Station
Other Electrical Infrastructure
Electrical Room
Mine Portable Unit Substation
NOTES:
SCALE 0 250 500 750 Metres

Source: KGHM Ajax Mining Inc., July 2017

1.4.2 PROJECT COMPONENTS AND ACTIVITIES

Project components are listed in Table 4 and project activities are listed in Table 5. The geographic location of project components is illustrated in Figure 1.

Table 4: Project Components

Component	Description
Open Pit	The open pit would be approximately 300 hectares in area and 577 metres (m) deep. Approximately 90 Megatonnes (Mt) of material would be removed annually.
Ore Stockpiles	Two stockpiles (one for low-grade ore and one for medium-grade ore) would be established to store approximately 45 Mt of ore throughout the mine life.
Ore Processing Plant	An on-site ore processing plant would produce copper and gold concentrates, using conventional crushing, grinding, and flotation technologies.
Thickened Tailings Plant	The tailings would be thickened by mechanically dewatering, for deposit into the tailings storage facility.
Tailings Storage Facility	The tailings storage facility would store thickened tailings, process water and contact runoff water. The tailings storage facility would be approximately 685 hectares and be designed to contain approximately 440 Mt of tailings in an area bounded by natural topography and 4 embankments.
Mine Rock Storage Facilities	Four mine rock storage facilities (south, east, west and in-pit) would have a combined storage capacity of 1,100 Mt and would buttress the tailings storage embankments or, in the case of the in-pit storage facility, the pit wall.
Overburden	Topsoil and overburden would be stockpiled primarily on top of the east mine rock storage facility. As the tailings storage facility expands its footprint, topsoil and overburden stockpiles would be placed within the site layout as necessary.
Water Management Facilities	Water collection ponds would redirect contact and runoff water to the site water management pond through pumps and pipes. Reclaimed water would be pumped from the site water management pond to the mill storage tank for reuse in ore processing, or alternatively to the tailings storage facility. Four engineered dams on Jacko Lake would provide flood control. A 2.7 kilometres (km) gravity discharge culvert, approximately 150 m

Component	Description
	downstream of the replacement dam on the southeast arm of Jacko Lake, would divert Peterson Creek flows around the south edge of the open pit.
Transportation	The Inks Lake Interchange would be upgraded to provide access from the mine site to Highway 5 (Coquihalla Highway). The existing 4 km mine access road would be upgraded to meet MOTI standards. On-site roads would be built to facilitate ore trucks and other vehicles travelling within the mine site.
Transmission Line	A 9 km, 230 kilovolt (kV) powerline would be constructed from the BC Hydro transmission line through Knutsford. KAM estimates Ajax's average power consumption for a typical year during operations at approximately 800,000 Megawatt (MW)-hours per year.
Natural Gas Pipeline	A 5.3 km natural gas pipeline from Knutsford (connecting with a Fortis pipeline) would support heating and back-up electricity generation.
Explosives Manufacturing and Storage Facility	The explosives manufacturing and storage facility would be located north of the Ajax access road connecting the site to Highway 5. The facility would store up to 100,000 kilograms (kg) of explosives.
Water Supply	An existing water intake in Kamloops Lake would be restored and upgraded with a new pump, piping and electrical system. Water would be delivered to a storage pond, shared with the New Afton Mine. Water would then be pumped through a new 16 km water supply line to the Ajax site.
Concentrate Storage and Shipping Area	The concentrate storage facility in the process plant would store concentrate (up to 10 days capacity) prior to loading onto sealed trucks.
Project related transport between the mine site and Highway 5	An estimated 14 concentrate trucks per day (40-tonne capacity) would transport concentrate along the Ajax Access Road and then on to Highway 5.
Ancillary Infrastructure	On-site buildings would include process buildings, an administration building, a laboratory, a truck shop and warehouse, fuel storage, and a wastewater (sewage, greywater) treatment system.

Table 5: Project Activities

Activities	Description
Construction	
Site Preparation	Clearing, grubbing and salvaging seed stock; Removing and stockpiling topsoil and overburden, pre-stripping historic open pit, and grading/levelling; and Constructing starter tailings storage facility embankment.
Construction of On-site Facilities[4]	Upgrading main haul road, including Inks Lake Interchange; Constructing surface facilities: a water management system (including tailings discharge pipeline, reclaim water intake and pipeline, collection ponds and ditches, and Jacko Lake dams), waste and sewage management systems, transmission line, and the natural gas pipeline; Installing the process plant, explosives manufacturing and storage, administration, truck maintenance shop and fuel storage buildings; Upgrading fresh water delivery system from Kamloops Lake, which includes a new 16 km water line; and Operating a concrete batch plant.
Operation	
Open Pit Mining	Operating explosives facilities, blasting, and extracting ore and waste rock; Developing pit, mine rock storage facilities, and ore stockpile; Ore crushing and conveying to processing plant; and Constructing tailings storage facility embankment using waste rock.
Ore Stockpiling	Stockpiling up to 45 Mt of low-grade and medium grade ore in 2 stockpiles.
Ore Processing	Crushing/grinding, flotation, concentrate dewatering and thickened

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[4] The existing Trans Mountain Pipeline crossing under the northeast arm of the lake (within lake area to be removed for development of the open pit) would be removed by Trans Mountain (as a separate project following applicable permits) during construction of Ajax.

Activities	Description
	tailings disposal.
Mine Waste and Water Management	Progressively constructing tailings storage facility embankments; Storing thickened tailings, process water and contact run-off water in the tailings storage facility; Storing waste rock in mine rock storage facilities; Dewatering open pit; and Collecting and managing site contact and surplus water.
Transportation	Transporting equipment, supplies, materials, concentrate and personnel between the mine site and Highway 5.
Maintenance and Reclamation Activities	Operating and maintaining project related facilities, including the transmission line, water delivery pipeline, and site access roads; Environmental monitoring; and Progressively reclaiming site during operation.
Decommissioning and Closure	
Decommissioning, Reclamation, and Closure	Decommissioning and removing equipment; Removing buildings and structures; Open pit partially filling with water through pumping of supernatant and natural groundwater seepage; Establishing long-term water management; and Completing various activities associated with reclamation and closure.
Post-closure	
Post-closure	Continuing monitoring and reclaiming the project site.

1.4.3 PROJECT SCHEDULE

The overall life of Ajax is divided into four phases: 2.5 years for construction, 23 years of operations, 5 years for decommissioning and closure, and 5+ years for post-closure monitoring. Decommissioning of some project facilities and progressive reclamation of the site would commence during operation. Reclamation of the site would continue during decommissioning and closure. Post-closure monitoring would be determined as required by government regulatory bodies.

1.4.4 NEED FOR AND PURPOSE OF THE PROJECT

Under the former Act, the need for a project describes the problem or opportunity that a project is intended to solve or satisfy. The purpose of a project describes what is to be achieved by carrying out a project.

KAM indicated that the need for Ajax is to meet market demand for copper and gold products that would contribute to the country's economic growth and stability, provide long-lasting benefits to the economies of local communities, and foster economic development opportunities in the natural resources sector. The purpose of Ajax is to supply copper and gold to the global market.

1.4.5 PROJECT CHANGES AS A RESULT OF THE ENVIRONMENTAL ASSESSMENT

KAM modified aspects of the project design during both the pre-EIS/Application and the EIS/Application review phases, in response to comments received during the EA. The key project design modifications included:

Pre-EIS/Application phase:

- Redesigned Ajax configuration such that the majority of the Ajax footprint now lies south of the City of Kamloops municipal boundary and farther away from the proposed City growth boundary neighbourhoods targeted for expansion (e.g., Aberdeen, Pineview Valley);
- Redesigned the tailings storage facility from a 'dry' facility to a conventional 'wet' facility with thickened tailings and mine-rock buttresses on the embankments, to reduce potential dust, noise, and visual effects on residences, and reduce the potential for accidents and malfunctions associated with the tailings storage facility design; and
- Moved the tailings storage facility to a location south of the open pit that would be further from the Coquihalla Highway and City of Kamloops relative to the proposed location for the 'dry' facility.

EIS/Application review phase:

- Revised the Fish Habitat and Fishery Offsetting Plan presented in the EIS/Application to address concerns with the long-term viability of compensation habitat in Inks Lake;
- Redesigned the Peterson Creek diversion system presented in the EIS/Application from the pump and pipe system that would have altered the outflow of Peterson Creek, and changed to a gravity outflow system, which resulted in retention of the opportunity for SSN to carry out the spring Rainbow trout fishery; and
- Developed mitigation measures for stream flow in lower Peterson Creek to reduce impacts to existing water licence holders and fish habitat during low flow conditions.

1.5 PROJECT ALTERNATIVES

1.5.1 ALTERNATIVES TO THE PROJECT

As a requirement of the EISG/AIR, KAM identified two alternatives to Ajax. Those were to delay Ajax until market conditions improve, or to abandon it.

KAM stated that delaying Ajax would likely result in the same environmental effects as KAM's preferred option of proceeding in the near-term. KAM stated that mining is a capital intensive industry and investors expect an early payback based on predictable short-term metal prices. This is critical to determining the feasibility of undertaking Ajax. KAM said that delaying Ajax would create financial risk due to the uncertainty in predicting future economic conditions.

If Ajax were abandoned, the biophysical environment would remain unchanged, but KAM indicated Ajax would therefore not contribute to economic growth and stability in BC, or meet the current and forecasted demand for copper and gold in global markets. In addition, KAM stated that the local socio-economic benefits would be lost, including employment, business opportunities, tax revenues, and local economic development.

1.5.2 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

The former Act and provincial Act require an assessment of technically and economically feasible alternative means of carrying out a project, and the environmental effects of those alternative means.

KAM considered alternative means in relation to the following project components and activities:

- General site arrangement;
- Tailings storage facility location;
- Tailings storage facility technology and management;
- Water use and supply;
- Jacko Lake management; and
- Peterson Creek realignment.

A summary of the key alternative means considered is presented below. KAM considered alternative means for other components and activities where public concerns were not raised as frequently as for those discussed below. For a summary of all alternative means considered by KAM see Appendix B.

1.5.2.1 *General Site Arrangement*

KAM reported that it considered two technically and economically viable general site arrangements: the north site and the south site. Early in the EA, KAM proposed the north site based on available land, proximity to the mill, ease of water management, and practicality for construction. For the north site, the dry stack tailings storage facility would have been located close to the Coquihalla highway, near Inks Lake, with some mine infrastructure located within the Kamloops city limits.

KAM amended the general site arrangement in May 2014, when it proposed the south option. The tailings storage facility was proposed to be re-located more than 5 km southeast from Inks Lake and farther from residential neighbourhoods in the City of Kamloops. As part of this option, KAM also changed the tailings storage technology from dry stack tailings to a thickened tailings storage facility and relocated the north mine rock storage facility, the processing plant, crushers and temporary ore stockpiles up to 3.5 km southeast relative to the proposed north site.

KAM identified the south site as its preferred option because mine infrastructure would be further from the nearest neighbourhoods and would be located within one watershed.

1.5.2.2 *Water Use and Supply*

KAM reported that the need for water during operations would be met primarily by recycling contact water from the tailings storage facility. However, additional make-up freshwater is required for the process plant and other operational needs, including potable water. Water supply alternatives are limited to expanding the existing system that supplies the New Afton mine or developing a new source and distribution system. Groundwater supply was initially considered, but not assessed further because of the limited groundwater resource. KAM considered the following alternatives: upgraded system from Kamloops Lake; captured run-off within the tailings storage facility catchment; and, treated effluent from the City of Kamloops.

Capturing run-off or using the City of Kamloops treated sewage effluent could supplement Ajax's water needs, but would not meet all of the water quantity and water quality (e.g., potable water) requirements. These alternatives would require additional site infrastructure, expand the project footprint, and affect vegetation, soils and wildlife, while still not meeting the operational needs for the mine. KAM does not consider these alternatives technically feasible because make-up water would still be required from another source.

KAM's preferred alternative is to restore the water intake on Kamloops Lake previously used for Teck's historic Afton Mine, which will convey freshwater to New Gold Inc's existing water supply pipeline for the New Afton Mine. KAM would add a new 16 km pipeline from the shared storage pond with the New Afton Mine to bring freshwater from the New Afton mine site to Ajax. Upgrading the intake would have a temporary impact on fish and fish habitat on the shoreline of Kamloops Lake. The effects of the new pipeline, such as disturbance to wildlife, would be confined to the pipeline corridor, which KAM predicted to be limited in extent.

1.5.2.3 *Jacko Lake Management*

Jacko Lake is a part of the area known as *Pípsell*, which is identified as a cultural keystone area for SSN. Jacko Lake is also a popular recreation area for fishers and outdoor enthusiasts. The lake is stocked by the Freshwater Fisheries Society of BC; MFLNR manages the recreational fishery and the stocking program. Water levels in Jacko Lake are currently managed through dams, with water releases managed by the provincial water bailiff to meet requirements of downstream water licences. KAM considered two options to manage Jacko Lake water levels during a large, 24-hr flood event: containment of the flood event within Jacko Lake; or, construction of an engineered berm and spillway to direct a portion of the flood waters into the open pit.

The first option would require installation of four dikes around Jacko Lake to contain the 24-hr flood event, and release of water gradually to the Peterson Creek diversion system to lower flood water in Jacko Lake over time. This option would allow the gradual release of flood waters to downstream licence holders on Peterson Creek, moderating a flood event; however, aquatic lakeshore habitat in Jacko Lake would be inundated until lake levels returned to normal. For the second option, KAM proposed installing two dams on the east side of Jacko Lake and directing the excess water through an engineered berm spillway to the open pit. This option would result in a loss of water flow to downstream licence holders, create a safety risk (i.e., erosion) for the open pit, and disrupt mining activity.

KAM's preferred alternative is containing the 24-hr flood event within Jacko Lake, and utilizing the Peterson Creek realignment to release excess water downstream.

1.5.2.4 *Peterson Creek Realignment*

Peterson Creek flows out of Jacko Lake and through the proposed mine site. KAM's preliminary alternatives assessment evaluated gravity discharge options (open channel and pipe) from the Jacko Lake Dam, and a pumped option whereby water discharged from the Jacko Lake Dam would be routed north around the open pit along the main mine access road.

Initially, KAM proposed a pumped option as the simplest and most economical to construct. KAM identified a north route following the main access road around the open pit that included a pumphouse at the northeast arm of Jacko Lake, and measures to maintain water circulation in the southeast arm of Jacko Lake. However, KAM stated that the shallowness of the lake in this location might have made it difficult to maintain flow circulation. This option would have also affected the SSN spring trout fishery at the outlet of Jacko Lake. KAM undertook further analysis and identified the preferred option as a gravity fed option from Jacko Lake into Peterson Creek, including a 150 m open channel at the outlet of Jacko Lake, a buried pipeline around the open pit, and release of water to Peterson Creek below the active mine.

KAM selected the gravity-fed option, as it would allow for SSN's fishery to remain at the outlet of Jacko Lake and maintain flows in Peterson Creek without the use of a pumphouse.

1.5.2.5 *Tailings Storage Facility Location, Technology and Management*

In response to the Mount Polley Independent Expert Engineering Investigation and Review Panel's (Independent Panel) report on the tailings facility breach at that mine, the EAO directed KAM on March 19, 2015 to complete additional alternatives assessment for any proposed tailings storage facility. KAM was required to assess options for tailings management that considered technology, siting and water balance. This assessment had to include consideration of best practices and best available technologies for tailings management, along with options for managing water balance to enhance safety and reduce the risk of a tailings dam failure during all phases of mine life. The Agency also required that KAM complete a failure and effects modes analysis.

KAM considered 12 candidate sites for the tailings storage facility, and selected 3 technically and economically viable potential locations within a 10 km radius of the proposed plant site for further assessment:

- Old Afton tailings storage facility, approximately 12 km to the southwest of the City of Kamloops and 9 km west of Ajax;
- Directly east of the Coquihalla Highway; and
- South of the open pit.

KAM considered whether each site could store "pumpable tailings" (i.e. conventional slurry, thickened or paste) or filtered dry stack tailings. KAM selected the site south of the open pit for the tailings storage facility as the preferred alternative because of its storage efficiency (footprint versus volume stored), low geotechnical risk, relative ease for water management, low downstream environmental sensitivity, and high cost efficiency relative to the other sites.

KAM considered four methods for managing the tailings in the tailings storage facility:

- Unthickened (conventional) tailings;
- Thickened tailings;
- Paste tailings; and
- Filtered dry stack tailings

KAM's assessment of these tailings disposal methods considered eight criteria, including physical stability, process make-up water requirements, and cost. The unthickened tailings (i.e. highest water content) require the most water to facilitate pumping to the tailings storage facility and would likely be the lowest cost option. KAM stated that the filtered dry-stack tailings method requires the least process water, can be self-supporting, and does not require an embankment for containment. However, dry stack tailings could result in increased dust levels and the technology has not been proven at Ajax's production rate. KAM noted that the paste tailings method also has not been proven at the Ajax production rate and is not cost-effective.

In selecting the thickened tailings management as the preferred method, KAM noted that recovery of water from the thickening process would reduce the supernatant volume in the tailings storage facility and that the higher solids content would increase the physical stability of the tailings deposited in the tailings storage facility.

The Agency and EAO carried out a review of the method and rationale for selecting preferred alternative means. In reviewing KAM's alternatives assessment for the tailings storage facility, the Agency and EAO also considered the recommendations of the Mt. Polley Independent Panel report and a subsequent letter sent on August 18, 2015 to the former Minister of Energy, Mines and Petroleum Resources from an Independent Panel member, Dr. Dirk Van Zyl. The Independent Panel recommended the use of best available technology for tailings storage. Dr. Dirk Van Zyl's letter emphasized that due to the varied geology, topography, and climate of BC, selecting a tailings management option requires site specific considerations. Dr. Van Zyl noted that a stable and resilient tailings deposit should be the number one design priority and there is no one recommended best available technology. The Independent Panel also recommended that applications for a new tailings storage facility be based on a feasibility analysis that considered all technical, social, and economic aspects of the Project in sufficient detail to support an investment decision. Applications for new tailings storage facilities are made as part of the *Mines Act* permitting process.

The Agency and EAO note that KAM convened an independent tailings review board to review their tailings storage alternatives assessment, and that Dr. Dirk Van Zyl provided a letter on behalf of the Ajax review board indicating that the Ajax tailings storage facility is an appropriate design. The EAO also notes that updates made on July 20, 2016 to the tailings storage facility requirements (Part 10) of the Health, Safety and Reclamation Code for Mines in British Columbia (Mining Code), which include design and operations requirements for water management and seismic issues, set a high standard of safety for the tailings storage facility. These changes are discussed further in section 20 of this Report.

1.5.3 PROJECT ALTERNATIVES ANALYSIS AND CONCLUSION

Considering the information presented by KAM in the alternatives assessment, the Agency, for the purposes of assessing the environmental effects of Ajax under the former Act, is satisfied that the KAM has sufficiently assessed alternative means of carrying out the project. The EAO finds KAM's plan for tailings storage to be consistent with the Independent Panel recommendations and finds the information provided by KAM adequately met the provincial EA requirements described above, recognizing that the Province would undertake further assessment as part of the *Mines Act* permitting process, should Ajax proceed.

Overall, the Agency and EAO are satisfied that KAM adequately considered technically and economically feasible alternative means of carrying out Ajax, and identified preferred means that take into account the environmental effects of the alternatives.

Further information regarding the tailing storage facility is found in section 20, Accidents and Malfunctions, of this Report.

1.6 PROJECT CHANGES AS A RESULT OF THE ENVIRONMENTAL ASSESSMENT

KAM modified aspects of the project design during both the pre-EIS/Application and the EIS/Application review phases, in response to comments received during the EA. The key project design modifications included:

Pre-EIS/Application phase:

- Redesigned Ajax configuration such that the majority of the Ajax footprint now lies south of the City of Kamloops municipal boundary and farther away from the proposed City growth boundary neighbourhoods targeted for expansion (e.g., Aberdeen, Pineview Valley);
- Redesigned the tailings storage facility from a 'dry' facility to a conventional 'wet' facility with thickened tailings and mine-rock buttresses on the embankments, to reduce potential dust, noise, and visual effects on residences, and reduce the potential for accidents and malfunctions associated with the tailings storage facility design; and
- Moved the tailings storage facility to a location south of the open pit that would be further from the Coquihalla Highway and City of Kamloops relative to the proposed location for the 'dry' facility.

EIS/Application review phase:

- Revised the Fish Habitat and Fishery Offsetting Plan presented in the EIS/Application to address concerns with the long-term viability of compensation habitat in Inks Lake;
- Redesigned the Peterson Creek diversion system presented in the EIS/Application from the pump and pipe system that would have altered the outflow of Peterson Creek, and changed to a gravity outflow system, which resulted in retention of the opportunity for SSN to carry out the spring Rainbow trout fishery; and
- Developed mitigation measures for stream flow in lower Peterson Creek to reduce impacts to existing water licence holders and fish habitat during low flow conditions.

1.7 ESTIMATED PROJECT BENEFITS

As required by the EAO, this section summarizes KAM's estimated economic and social benefits of Ajax as outlined in the EIS/Application.

1.7.1 ECONOMIC BENEFITS

KAM estimated revenue and employment benefits during construction and operations. KAM indicated that Ajax would have local, regional, and national economic benefits over the construction phase (2-3 years) and operations phase (18-23 years), as well as lesser benefits over the decommissioning and closure phase (5 years), which are not enumerated here. KAM assessed direct expenditures and direct employment benefits as well as indirect (supply chain) and induced (spending by workers) benefits. KAM estimated direct, indirect and induced employment income during construction and operations of Ajax as predicted using Statistics Canada Input-Output model, which is a standard economic impact model regularly used in EAs.

KAM stated that the construction phase would result in 9,725 person years of employment in BC and 3,715 person years of employment in the rest of Canada (excluding BC). During operations, Ajax would, on average, employ 1,450 full time equivalent positions in BC and 540 in the rest of Canada. KAM proposed a local hiring strategy, and presented scenarios in the EA for low and high levels of local employment.

KAM has committed to hiring local workers and provided an estimated range of the number of construction jobs that they would attempt to source locally over the course of construction.

Table 6: Estimated Ranges of Total Local Employment during Construction.

	Year 1		Year 2		Year 3	
	Low	High	Low	High	Low	High
Total Local Hires, including direct, indirect, and induced	1,205	1,425	1,510	1,850	765	950

Source: Table 7.2-6 in the EIS/Application

KAM estimated project construction phase expenditures (e.g. capital costs, equipment, supplies) at $1.54 billion and project operations phase expenditures at $299 million per year on average, or $6.9 billion in total over the 23-year operations phase. Direct employment earnings in Kamloops were estimated to range from a total of $183 to $242 million during construction and average $53 million annually during operations.

Using Statistics Canada Input-Output model, KAM estimated Ajax's contributions to provincial and federal gross domestic product (GDP) and estimated tax revenues at the federal, provincial, and local levels. During the two year construction phase, Ajax contributions to GDP are estimated at $873M in BC and $409M in the rest of Canada. Overall Ajax related tax revenue is estimated to be $354M nationwide, with federal tax revenue of $162M, provincial revenue of $115M, and local revenue of $25M. Table 7 shows the same data for the 23 year operations phase.

Table 7: Estimated Gross Domestic Product and Government Revenue from Operations Phase (Direct, Indirect, and Induced Impacts; 2015 Cdn$).

	Total Operating Phase (23yrs)		Annual Average	
Impact	BC	Rest of Canada	BC	Rest of Canada
GDP	$5.1 billion	$1.5 billion	$222 million	$67 million
Tax Revenue (Nationwide)	$1.9 billion		$84 million	
Federal Taxes	$858 million		$37 million	
Provincial Taxes	$710 million	$152 million	$31 million	$6.6 million
Local Taxes	$160 million	$41 million	$6.9 million	$1.8 million

Source: Table 7.1-4 from the EIS/Application.

The Agency and EAO recognize that SSN conducted their own assessment processes that evaluated the potential economic benefits of Ajax on their members. SSN questioned the assumptions used by KAM to determine the economic benefits and disagreed with KAM's estimated economic benefits of Ajax to their members. SSN concluded that Ajax would have an adverse effect on SSN's Indigenous economy. Section 24 of this Report provides additional information on SSN's assessment of the economic benefits of Ajax.

1.7.2 SOCIAL AND COMMUNITY BENEFITS

In addition to Ajax's contribution to local employment, business opportunities, and other economic benefits associated with mine construction and operation, KAM has committed to provide and support a variety of social and community-focused benefits in the Kamloops area. KAM has committed to enhancements to the boat launch, day use area and shoreline trails at Jacko Lake. As part of requirements for fish habitat offsetting, KAM plans to conduct fish habitat enhancement near the mouth of lower Peterson Creek.

KAM has committed to establishing a community benefits agreement with the City. KAM has stated that this agreement would cover KAM's use of local services (e.g., waste management, road maintenance, and emergency services, among others), policies related to local employment and procurement, and support for local education and training. In addition, the community benefits agreement, valued at $3.8 million annually, would help address Ajax's contributions to community and social services, affordable housing, community amenities, local healthcare, and other financial and/or in-kind contributions to local services and wellbeing. On July 17, 2017, Kamloops City Council voted to support the agreement in principle.

As part of the community benefit agreement with the City of Kamloops, KAM has committed to maintain and expand its community contribution program. This program has provided financial support to local organizations over the past five years, and KAM has committed, as part of the community benefit agreement with the City of Kamloops, to providing $300,000 annually to local organizations for the life of Ajax.

Part B – Assessment of Potential Adverse Effects

Sections 2 to 19 of the Report discuss the potential environmental, health, social, economic, and heritage effects of Ajax on valued components. In the development of the Report, the Agency and EAO considered KAM's EIS/Application, additional information received during the review period, comments received from working group members, Indigenous groups, and the public, as well as proposed mitigation measures and proposed provincial EA Certificate conditions.

2 Surface Water Quality and Quantity

2.1 BACKGROUND

This section provides a summary of potential effects of Ajax on surface water quality and quantity as identified by KAM, the mitigation measures proposed by KAM to address those effects, and a discussion of the key surface water quality and quantity issues raised during the EA. It also sets out the analysis and conclusions of the Agency and EAO regarding Ajax's potential adverse effects to surface water quality and quantity.

Changes in surface water quality or quantity have the potential to impact ecological values and humans. Therefore the results this assessment inform the following assessments: Fish and Fish Habitat (section 4), Vegetation (section 5), Wildlife (section 6), Human Health (section 10), Land and Resource Use (section 15), and Aboriginal Interests (Part C).

Water quality is assessed by the provincial government through comparison of predicted or measured concentrations with Approved and Working Water Quality Guidelines.[5] In some cases, a proponent may propose site-specific benchmarks (such as science-based environmental benchmarks) during the provincial waste discharge permitting phase under the *Environmental Management Act*. KAM proposed a number of preliminary environmental benchmarks which are discussed in this report and which would be refined in the permitting stage, should Ajax proceed.

The *Water Sustainability Act* is the principal legislation in BC for managing the diversion and use of water resources and would guide subsequent water quantity permitting and regulatory requirements, should Ajax proceed.

Environment and Climate Change Canada (ECCC) and DFO advised that because Ajax would not require the use of natural water bodies frequented by fish for the disposal of mine waste, an amendment to Schedule 2 of the *Metal Mining Effluent Regulations* would not be required. However, KAM has committed to undertake monitoring, follow-up, and adaptive management as necessary to ensure KAM complies with the *Fisheries Act* and reporting requirements of the *Metal Mining Effluent Regulations.*

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[5] MOE. BC Approved and Working Water Quality Guidelines. Available at: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines

2.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

2.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

Ajax is located predominantly within the Peterson Creek watershed, which has an area of approximately 130 km^2 and discharges to the South Thompson River.

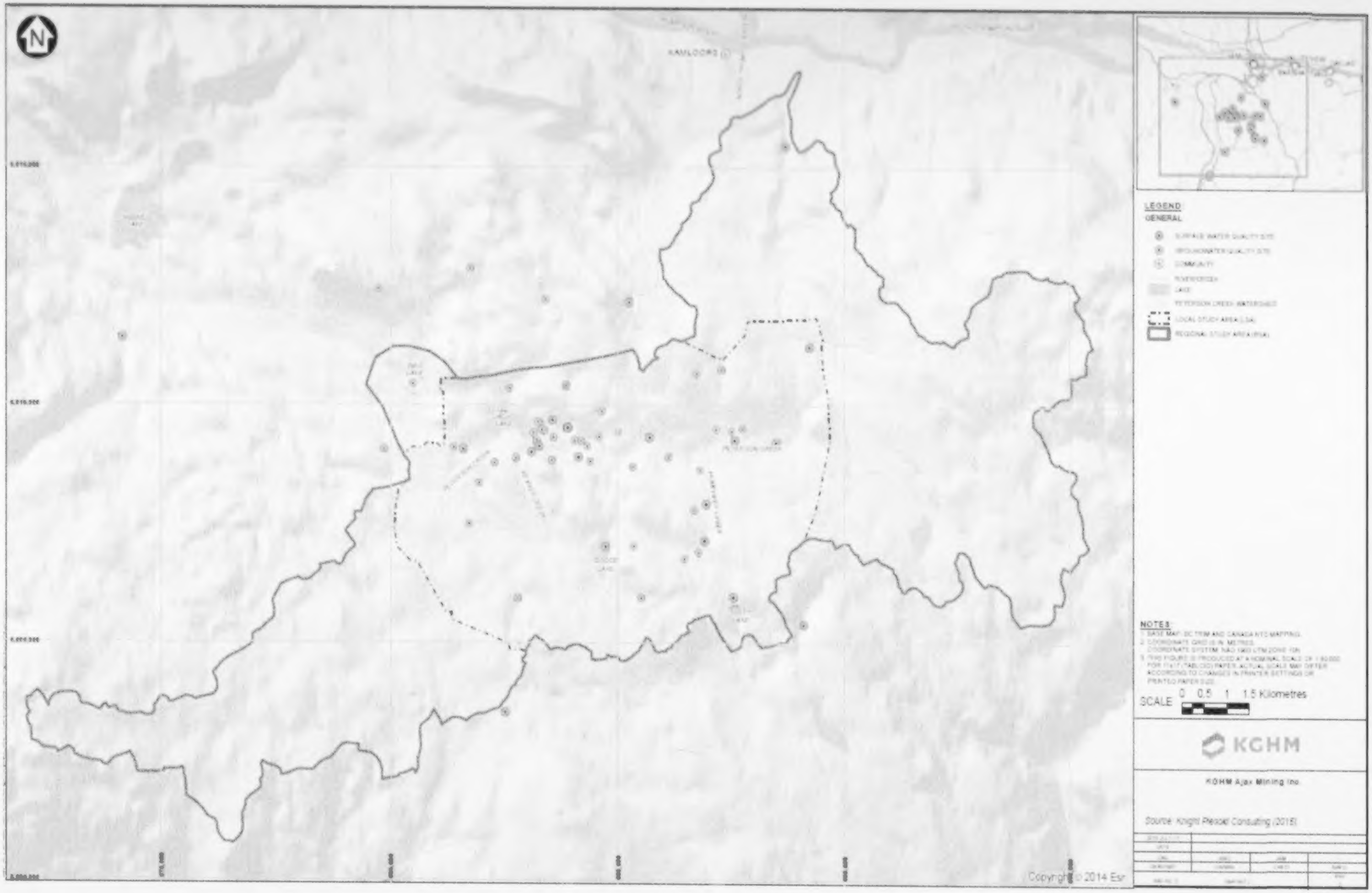
The surface water regional study area includes most of the Peterson Creek watershed and is characterized by rolling hills, evaporative lakes, and small creeks that are all influenced by the arid climatic conditions. The chemistry of waterbodies in the regional study area is hard to very hard, and alkaline. There are numerous evaporative lakes that are sustained by groundwater inflows, spring melt, and precipitation. Creek flows are highly dependent on precipitation and are predominantly sustained by groundwater recharge outside of spring freshet.

The local study area includes Goose Lake, Jacko Lake, and Edith Lake (Figure 3). Goose Lake is a small, shallow waterbody situated within the proposed tailings footprint; it would be permanently lost should Ajax proceed. While mapped and gazetted as a lake, Goose Lake is more aptly described as a pond due to its depth of less than 1 m and lack of an aphotic zone (portion of a lake where there is little or no sunlight). Goose Lake is neither navigable nor fish bearing, although it supports other aquatic life and migratory birds (see sections 4 and 6).

Jacko Lake is located to the west of, and adjacent to, the proposed location of the open pit. The northeast arm of the lake would be removed during construction to allow for the relocation of the existing Kinder Morgan pipeline (which currently runs below the northeast arm) and development of the open pit. Jacko Lake has been altered since the early 1900s when an earthfill dam was constructed at the outlet of the lake to raise the water level to provide capacity for downstream irrigation purposes. Since then, the dam has been raised several times and is currently at a height of approximately 3 m. There is a high level outlet (spillway) for high flow periods and a low level outlet that is managed by a provincial water bailiff during lower flows in the summer months in order to manage downstream water demands for existing licence holders on Peterson Creek. According to MFLNR, the current licensing requirements cannot be met during dry years (approximately 20% of the time).

Peterson Creek flows in a northeasterly direction through Jacko Lake, then through the community of Knutsford, and finally through downtown Kamloops, where it is mostly contained in culverts and concrete waterways, until it converges with the South Thompson River. Jacko Creek, Keynes Creek, Humphrey Creek, and Davidson Brook are tributaries of Peterson Creek. Edith Lake is located approximately 1.5 km southeast of Ajax and is the headwater of Humphrey Creek. Humphrey Creek is located to the east of Ajax and flows in a northerly direction from Edith Lake into lower Peterson Creek (see Figure 2).

Figure 2: Surface Water Local and Regional Study Areas


KAMLOOPS
LEGEND
GENERAL
SURFACE WATER QUALITY SITE
GROUNDWATER QUALITY SITE
COMMUNITY
RIVER/CREEK
LAKE
PETERSON CREEK WATERSHED
LOCAL STUDY AREA (LSA)
REGIONAL STUDY AREA (RSA)
NOTES:
1. BASE MAP: BC TRIM AND CANADA NTS MAPPING.
2. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N.
3. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:80,000 FOR 11x17 (TABLOID) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.
SCALE 0 0.5 1 1.5 Kilometres
KGHM
KGHM Ajax Mining Inc.
Source: Knight Piésold Consulting (2015)
Copyright © 2014 Esri

Source: KAM Environmental Impact Statement/Application for Environmental Assessment Certificate, December 2015

KAM's characterization of the baseline surface water quality conditions was based on comparison of measured concentrations of parameters to the most stringent applicable water quality guidelines.[6] The baseline surface water quality and quantity characteristics for the local and regional study areas were described by KAM as follows:

- Measured pH occasionally exceeds the drinking water quality guidelines (freshwater) throughout the local study area;
- Total dissolved solids are generally elevated throughout the regional study area and frequently exceed the drinking water quality and irrigation water quality guidelines;
- Sulphate concentrations are elevated and exceed applicable livestock, aquatic life, and drinking water quality guidelines throughout the regional study area during periods of low flow;
- Chloride and fluoride concentrations occasionally exceed freshwater aquatic life guidelines throughout the local study area;
- Nutrient loading in the regional study area is dominantly phosphorus-related and largely due to agriculture, with lakes ranging from mesotrophic to hyper-eutrophic;
- Metal concentrations are typically below applicable guidelines in Jacko Lake, but exceed applicable guidelines in creeks in the local study area (i.e., Peterson Creek, Humphrey Creek, and Keynes Creek). During spring freshet, concentrations of aluminum, copper and iron frequently exceed the freshwater aquatic life guidelines. During periods of lower runoff when groundwater is a more dominant portion of the total flow, manganese and molybdenum exceed the aquatic life guidelines. Selenium concentrations are also elevated, with exceedances noted in Keynes Creek, Peterson Creek, lower Humphrey Creek, and Jacko Lake, particularly during low flow periods;
- Metal concentrations in Inks Lake are higher than in other water bodies in the local study area and frequently exceed applicable guidelines for the protection of aquatic life, livestock/wildlife, and drinking water; and
- Peak streamflows in Peterson Creek and other creeks in the regional study area generally occur during spring freshet (April through June) when the snow melts. During other times of the year, and even after large rain events in the summer and fall, creek flows are generally low due to the relatively permeable and dry soils that readily absorb precipitation and limit the amount of runoff. By late summer, there is typically no surface runoff observed at upper Peterson Creek (i.e. upstream of Jacko Lake). During winter low flows (November through February), there is typically little to no visible surface flow in portions of

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[6] Water quality guidelines include the MOE Approved and Working Water Quality Guidelines (for drinking water supply, freshwater aquatic life (maximum and 30-day average), livestock water supply, irrigation and recreation), the Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines (for the protection of aquatic life (freshwater), agriculture (livestock), agriculture (irrigation) and wildlife), and Health Canada (HC) Guidelines for Canadian Drinking Water Quality and Recreational Water Quality. Collectively, these are referred to as the "generic guidelines."

Peterson and Humphrey Creeks. During these low flow periods, groundwater makes up the dominant portion of the visible flow in the creeks.

2.2.2 POTENTIAL EFFECTS TO SURFACE WATER QUALITY AND MITIGATION MEASURES

KAM identified the following potential effects to surface water quality from Ajax:

- Clearing, grubbing and earthworks activities during construction and development of project facilities could increase soil erosion and contribute sediments to existing surface waterbodies;
- Dust generated during project activities that settles on surface waterbodies could impact water quality;
- Mine contact water (i.e., water of degraded quality due to contact with mine components or activities) that enters receiving waters could result in increased concentrations of water quality parameters. Sources of contact water include:
    - Seepage and metal leaching from the tailings storage facility, mine rock storage facilities, and temporary stockpiles during all project phases;
    - Surface runoff from reclaimed mine facilities (during decommissioning and closure and post-closure); and
    - Accidental release of contact water (i.e. spills) during all project phases.

KAM stated that Ajax would not discharge any surface water to the environment during operations and that all contact water would be directed to the various diversion and seepage collections systems at the site, or the tailings storage facility. At closure, mine facilities would be reclaimed and surface runoff from these facilities would be allowed to discharge to the environment once monitoring results indicated that the water met applicable water quality guidelines and/or science-based environmental benchmarks.

Key mitigation measures proposed by KAM to avoid or minimize the potential effects on surface water quality from sediment and contaminant loading include:

- Construction of water management ponds to capture seepage and surface contact water from mine features, such as the tailings storage facility and the mine rock storage facilities. The water from these facilities would be temporarily stored for re-use in mining operations;
- Features to manage tailings storage facility seepage including an underdrain system in the embankment foundation and an embankment liner system;
- Reclamation of mine rock storage facilities with a low permeability till layer overlain with topsoil to reduce infiltration and maximize evapotranspiration and runoff;
- Reclamation of the tailings storage facility with a dry cover, to limit infiltration into the underlying tailings and to reduce seepage. The surface runoff from the facility would be directed into the Humphrey Creek watershed at closure, after monitoring results indicate that water quality meets applicable guidelines and/or science-based environmental benchmarks; and
- Air quality management and measures to reduce dustfall loading to surface water bodies (see section 8 for details on KAM's proposed air quality mitigation measures).

KAM identified additional mitigation options that could be considered and potentially implemented at Ajax should exceedances in water quality benchmarks be identified in the surface water and/or groundwater monitoring network, following an adaptive management approach. These options include, but are not limited to:

- Grouting for reducing rockmass hydraulic conductivity to depths of up to 60 m below grade to limit seepage water losses from reservoirs;
- Installing seepage interception wells to capture contaminated groundwater and limit its migration to an area of concern located downgradient of mining operations (e.g., lakes, streams, well fields, etc.);
- Installing pressure relief wells to intercept seepage and lower pore pressures; and
- Installing permeable reactive barriers to treat organic and inorganic contaminants.

Mine rock would be managed in accordance with the Metal Leaching/Acid Rock Drainage Management Plan and with requirements under the *Mines Act* and the *Environmental Management Act*. The key management approach in the plan is to construct the west mine rock storage facility with non-potentially acid generating mine rock, and to blend any mine rock that is identified as potentially acid generating with mine rock that has sufficient neutralizing potential such that there would be no acidic drainage from the stored mine rock.

2.2.3 KAM's Conclusions on Residual Effects to Surface Water Quality

KAM developed a water quality model to estimate the concentrations of various parameters in surface water in Jacko Lake, Peterson Creek, and Humphrey Creek. The model was based on a mass balance approach with various inputs including hydrological, geochemical, dustfall, and baseline water quality data. The water balance and the water quality model took into account KAM's proposed mitigation measures for surface water quality.

The "base case" water quality scenario used average monthly climate data as inputs to the model. The base case was considered by KAM to be the most likely scenario year over year. KAM also ran thirteen sensitivity analyses to assess variations in the model's outputs from different inputs and assumptions, including variations in dustfall assumptions, hydrogeological assumptions, climate considerations and transit times of mine seepage.

KAM compared the modelled concentrations of parameters at each assessment node (location) to existing baseline conditions and applicable water quality guidelines, as well as any proposed applicable water quality benchmarks or science-based environmental benchmarks.

KAM found that Ajax would result in the following residual effects to surface water quality:

- **Humphrey Creek:** Changes in concentrations of nitrate, aluminum, arsenic, copper, total iron, molybdenum, and selenium; and
- **Peterson Creek:** Changes in concentrations of aluminum, antimony, arsenic, chloride, copper, iron, molybdenum, nitrate, selenium, sulphate and uranium.

For Humphrey Creek, KAM indicated that the changes in parameter concentrations would occur as a result of dustfall loading and potential seepage of contact water from the south mine rock storage facility that could surface in Humphrey Creek during all project phases. During post-closure, surface runoff from the reclaimed tailings storage facility and reclaimed south mine rock storage facility would also contribute to these changes in water quality. KAM predicted that the effects would be greatest for selenium and aluminum, since base case concentrations of these parameters were predicted to seasonally exceed the baseline range and applicable water quality guidelines, water quality benchmarks and/or science-based environmental benchmarks.

For Peterson Creek, KAM indicated that the changes in concentrations would occur as a result of dustfall loading and potential seepage and runoff of contact water from the south, west and east mine rock storage facilities surfacing in Peterson Creek during all project phases. Immediately downstream of mine facilities, KAM predicted that the effects would be greatest for selenium and sulphate, since base case concentrations of these parameters were predicted to seasonally exceed the baseline range and applicable water quality guidelines, water quality benchmarks and/or science-based environmental benchmarks. KAM stated that additional mitigation could be implemented to minimize seepage of contact water into Peterson Creek, including optimizing the closure covers for the tailings storage facility and waste rock storage facilities to minimize infiltration. Additional mitigation could also include enhanced flow barriers between the mine rock storage facilities and Peterson Creek combined with features such as French drains that would convey surface discharge into the open pit, rather than Peterson Creek.

KAM did not identify residual effects to water quality in Jacko Lake because no parameters were predicted to exceed guidelines, water quality benchmarks and/or science-based environmental benchmarks in any of the modelled scenarios.

2.2.4 Potential Effects to Surface Water Quantity and Mitigation Measures

KAM indicated that Ajax could potentially alter surface water patterns and flows in Peterson Creek, Jacko Lake and, to some extent, in Kamloops Lake during all project phases. Ajax would operate at a water deficit, meaning that additional water would need to be brought to the site to support mining operations. This additional water would be drawn from Kamloops Lake at a maximum rate of 1,505 m^3/h (although KAM estimated that their average use of this source during operations would be approximately 990 m^3/h) and would be used as make-up water in the process plant, and also for potable water uses and dust control. This would reduce flows in Kamloops Lake and the Thompson River. KAM indicated that the 1,505 m^3/h allotment from Kamloops Lake and reduced flows in lower Peterson Creek would constitute less than 0.25% of the average monthly flow through the lake. Contact water would be intercepted in water management ponds downstream of key project components and recycled for use in the process plant to minimize process water requirements.

During decommissioning and closure, the open pit would fill with water (both surface runoff and groundwater seepage), thereby reducing the flows to lower Peterson Creek. KAM stated that freshwater would continue to be drawn from Kamloops Lake as needed to support closure activities, and the maximum water extraction during decommissioning and closure would be 100 m^3/h.

At post-closure, the open pit would continue to fill from runoff and groundwater inflows. Surface runoff from the reclaimed tailings storage facility would flow into the Humphrey Creek watershed, which is located to the east of Ajax facilities and is tributary to lower Peterson Creek, and the water management ponds located downstream of the reclaimed mine rock storage facilities.

KAM identified the following potential effects related to surface water quantity:

- Reduced streamflows in Peterson Creek (upper and lower) during all project phases as a result of a reduced watershed size, capture of contact water, and potential seepage from Jacko Lake to the open pit, which would impact the amount of water available for fish and fish habitat and existing water licence holders;
- Reduced streamflow in Kamloops Lake and the Thompson River as a result of withdrawing water from Kamloops Lake at a maximum rate of 1,505 m^3/h to support project construction, operations, and decommissioning and closure; and
- Reduced streamflow indirectly affecting water quality and aquatic life.

Potential effects to fish and fish habitat and to downstream water licensees are assessed in Sections 4 and 15 of the Report, respectively.

Key mitigation measures proposed by KAM to avoid or minimize the potential effects to surface water quantity include:

- Diverting non-contact water back into the watershed (i.e. diversion of Peterson Creek around mine infrastructure) to minimize losses to the watershed; and
- Capturing and temporarily storing contact water, including surface runoff and seepage, in water management ponds for reuse in the process plant, which would reduce the amount of make-up water needed from Kamloops Lake.

During the review period, KAM proposed additional mitigation measures to address the predicted reductions in streamflow and the related effects to water licence holders on Peterson Creek. These mitigation measures were proposed at a conceptual level and would require further development and discussion with regulators, should Ajax proceed. The measures included:

- Pumping water from Kamloops Lake to Jacko Lake to make up the streamflow deficit throughout the operations phase using Ajax's proposed freshwater delivery system; and
- Continued pumping from Kamloops Lake post-closure, or implementation of another mitigation measure such as acquisition of water licences on Peterson Creek.

2.2.5 KAM'S CONCLUSIONS ON RESIDUAL EFFECTS TO SURFACE WATER QUANTITY

KAM used a water balance model to estimate the monthly runoff quantities for the base case scenario (which used average precipitation conditions) and six sensitivity scenarios (which considered variations in the inputs related to climate, the mine rock storage facilities, and groundwater assumptions).

KAM's assessment of residual effects to surface water quantity did not take into consideration the additional mitigation measures that KAM proposed during the review period related to flow augmentation from Kamloops Lake, as these were introduced at a conceptual level during the review period. KAM concluded that, after implementation of other mitigation measures described above, Ajax would result in the following residual effects to water quantity:

- Reduced streamflows in upper and lower Peterson Creek;
- Reduced peak flows in lower Peterson Creek; and
- Reduced streamflows in Kamloops Lake.

Refer to Sections 2.3.9 and 2.4 of this Report for a discussion and analysis of the additional streamflow mitigation measures that KAM proposed related to flow augmentation.

For lower Peterson Creek, under average precipitation and unregulated[7] flows from Jacko Lake, KAM predicted that annual streamflow volumes downstream of the mine site would be reduced by approximately 12% at the end of operations and 5% at the post-closure phase (100 years after closure). Monthly flow changes have a high range of variability; in the post-closure phase (100 years after closure), KAM predicted that the monthly streamflow reductions downstream of the mine site would range from 2% (May) to approximately 60% (January) for the unregulated condition.[8]

For upper Peterson Creek, there would be a reduction in watershed area by 78 hectares because of the Ajax footprint and collection of contact water, which would result in reduced streamflows in upper Peterson Creek starting in operations and continuing at least 100 years post-closure. This change combined with seepage from Jacko Lake to the open pit would result in a reduction of net inflows to Jacko Lake. Under average runoff conditions, the net inflow to Jacko Lake would decrease by 75,000 m^3 on an annual basis by the end of operations.

The reductions in watershed area and streamflow would affect licence holders on Peterson Creek (upper and lower) and Jacko Lake in years of average or below average flows. Licence holders on upper Peterson Creek would be affected indirectly, as they would only be able to exercise their licences if the downstream licenced demand has been met. Refer to section 15 for the assessment of effects to land and resource use, including licence holders.

For Kamloops Lake, KAM indicated that the 1,505 m^3/h maximum withdrawal rate from Kamloops Lake and reduced flows in lower Peterson Creek would result in a reduction of less than 0.25% of the average monthly flow through Kamloops Lake.

2.2.6 Cumulative Environmental Effects (Surface Water Quality and Quantity)

KAM stated that the baseline conditions considered in the water quality model already account for the effects from nearby residential properties, roads and highways, rangeland, the sand and gravel quarry located adjacent to Peterson Creek, and contributions from the neighbouring Davidson Creek aquifer (Separation Lake area). KAM evaluated the cumulative effects that would be experienced in the Thompson River as a result of Ajax's interaction with the cumulative sources considered in the water quality model, and also assessed the effects of urban runoff loading from the City of Kamloops in a desktop analysis of common urban runoff parameters in lower Peterson Creek. KAM indicated that the cumulative change in water quality parameter concentrations in the Thompson River is anticipated to be below the limits of analytical detection. Therefore, KAM concluded that the cumulative residual effect to water quality in the Thompson River is considered negligible.

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[7] The regulated condition assumes the water bailiff manages the water levels in Jacko Lake to meet downstream water licence demands. The unregulated condition assumes that outflows from Jacko Lake exit the lake only when lake levels naturally exceed the spillway invert elevation.

[8] For complete results, refer to memo 1214_KAM_BGC Surface Water Working Group Round 2 Responses available at: https://projects.eao.gov.bc.ca/p/ajax-mine/docs?folder=233

For surface water quantity, KAM identified one reasonably foreseeable project or activity as having a potential cumulative effect on surface water quantity in the regional study area. At the time the EIS/Application was submitted, the New Afton Mine was licenced to draw an annual volume of 1.218 Mm^3 (139 m^3/h) of water from Kamloops Lake to support its processing plant. New Afton received a short-term use approval in December 2016 to withdraw an additional 151 m^3/h from Kamloops Lake. The cumulative effect of this in combination with the proposed water usage for Ajax would result in a reduction in streamflow of less than 0.35% for both the average monthly flows and 10-year monthly low flows through Kamloops Lake. KAM did not propose additional mitigation measures for this cumulative effect at Kamloops Lake and indicated that the cumulative effect on surface water quantity is predicted to be negligible. However, in March 2016, KAM sent a letter to the Province requesting that it consider initiating a water stewardship study for the Kamloops Lake watershed, and offered to support such an initiative. See further discussion in section 2.3.10.

2.2.7 MONITORING AND FOLLOW-UP (SURFACE WATER QUALITY AND QUANTITY)

KAM proposed to verify its water quality and quantity effects predictions and the effectiveness of its proposed mitigation measures by developing and implementing a Surface Water and Groundwater Monitoring and Management Plan. This plan would outline procedures for minimizing effects to surface water and groundwater and would address regulatory compliance, monitoring requirements, and adaptive management strategies.

KAM also proposed to develop and implement a Water Management and Hydrometric Monitoring Plan that would describe strategies and activities for managing surface water quantity, including diverting non-contact water, minimizing generation of contact water, and collecting and reusing contact water at the site, as well as requirements related to monitoring and regulatory compliance with any permits issued under applicable legislation, including the *Water Sustainability Act* and the *Environmental Management Act*.

In addition, KAM proposed to develop and implement the following monitoring and management plans related to surface water:

- Metal Leaching/Acid Rock Drainage Management Plan, which would outline procedures to prevent the generation of acid rock drainage from the mine rock storage facilities, tailings storage facility and ore stockpiles and minimize the impact of metal leaching to the receiving environment;
- Fish and Fish Habitat Offsetting Plan, which would address minimum flow requirements for ecological needs, including fish habitat; and
- Erosion and Sediment Control Plan, which would describe measures for minimizing erosion and the introduction of sediment to waterbodies.

2.3 DISCUSSION OF ISSUES

During the EA, members of the working group, including Indigenous groups, and the public raised concerns related to the potential effects of Ajax on surface water quality and quantity. This section provides a summary of KAM's responses to the key issues identified.

2.3.1 HISTORIC WATER QUALITY AND BASELINE CONDITIONS

MOE and SSN were concerned that KAM's baseline water quality data may not be representative of the natural background concentrations because the baseline information did not include data for the period prior to mining activities at the historic Afton Mine (i.e., prior to 1989). MOE, ECCC, and SSN questioned whether the sources of the existing elevated concentrations of some parameters that appeared to be heavily influenced by loading from groundwater baseflow were natural or influenced by historic mining activities. These reviewers also questioned whether urban runoff had been considered as a potential contributor to surface water quality in Peterson Creek. NRCan emphasized the need for appropriate plans for monitoring and treatment of potential contaminants such as selenium, molybdenum and arsenic due to both historic and current mining disturbances in the area. In response, KAM reviewed additional historical (i.e. pre-1989) water quality data. KAM also undertook additional analyses of water quality data and trends in lower Peterson Creek, which included assessing surface water-groundwater interactions and the potential influence of urban runoff. KAM suggested that increasing concentrations of sulphate, selenium, and uranium in surface water with distance downstream in Peterson Creek could be attributed to groundwater discharge, since these parameters were also elevated in groundwater samples.

KAM committed to undertaking further investigation work in consultation with MOE in subsequent design phases and in support of permit applications under the *Environmental Management Act*, to better understand the site-specific conditions that affect concentrations of parameters of concern, particularly selenium and sulphate. This information would help inform further development of site-specific benchmarks for these metals, which would be required for permitting, should Ajax proceed.

2.3.2 PROPOSED SITE-SPECIFIC BENCHMARKS

MOE and SSN noted that water quality benchmarks and science-based environmental benchmarks are developed for parameters where natural background concentrations exceed the generic water quality guidelines. MOE and SSN questioned whether the identified water quality exceedances were due to anthropogenic or natural sources, and how this affected the rationale for the water quality benchmarks or science-based environmental benchmarks.

KAM proposed preliminary site-specific water quality benchmarks for a number of parameters whose concentrations exceeded the generic guidelines under baseline conditions, including chloride, arsenic, copper, molybdenum, and selenium. KAM also developed preliminary science-based environmental benchmarks for sulphate. KAM developed the preliminary benchmarks in consideration of the site-specific water quality conditions and aquatic life in the local study area.

MOE and ECCC expressed disagreement with some aspects of KAM's proposed water quality benchmarks for selenium, molybdenum, copper, and arsenic, and indicated that further studies and discussions would be required before these benchmarks could be accepted. For these parameters, MOE indicated that predicted water quality concentrations should be compared to the generic water quality guidelines. KAM acknowledged that additional testing and assessment in support of the proposed site-specific benchmarks would be required during the permitting phase, and disagreed with MOE's views on a number of the proposed benchmarks, indicating that the duration and seasonality of concentration fluctuations were not sufficiently considered in MOE's review. In particular, KAM noted that many of the elevated concentrations occur during periods of low flow in the wintertime when the most sensitive aquatic life stages are typically not present. Furthermore, KAM's water quality model indicated that concentrations of many of these parameters in lower Peterson Creek and Humphrey Creek are predicted to be below guidelines during early spring and summer when trout and amphibians use the habitat.

2.3.3 POTENTIAL EFFECTS ON ECOLOGICAL RECEPTORS

MOE indicated that the predicted concentrations of aluminum, copper, arsenic, nitrate, antimony, and uranium in lower Peterson Creek would exceed aquatic life guidelines in some sensitivity cases. Predicted concentrations of selenium and sulphate exceeded the maximum water quality guidelines for the protection of aquatic life under most scenarios and sensitivity cases. MOE noted that the elevated sulphate concentrations could affect aquatic life. MOE, ECCC, and the City of Kamloops indicated that there are uncertainties related to the future concentrations of selenium in water and related effects to aquatic life. These reviewers noted that selenium bio-accumulates, and could potentially accumulate in the sediment in Peterson and Humphrey Creeks, and move up the food chain. MOE noted that KAM would be required to provide additional site-specific data for these and other parameters during the permitting phase, should Ajax proceed.

For chloride, MOE noted that exceedances of the aquatic life guidelines and irrigation guidelines were predicted in Peterson Creek for the base case and a number of sensitivity cases. MOE indicated that chloride-sensitive plants could potentially be affected if irrigated with this water.

For molybdenum, MOE indicated that the predicted elevated concentrations in surface water in Peterson Creek and Humphrey Creek could potentially affect the health of wildlife and livestock. The Lower Nicola Indian Band also raised concerns regarding the elevated concentrations of molybdenum in surface water, soil, and vegetation in the project area and questioned whether there could be potential health effects to cattle and wildlife, as well as people who may consume cattle and/or wildlife from the area. KAM committed to monitoring metal concentrations in water, soil, and vegetation as part of on-going environmental effects monitoring and indicated that this information would be used to verify the exposure predictions contained in the human health and ecological risk assessment. If monitoring results indicated a change in water quality or soil and plant quality that differed from the predictions presented in the human health and ecological risk assessment, KAM indicated that potential effects would be mitigated through adaptive management.

During the review period, MOE, MFLNR, and DFO confirmed that Humphrey Creek is not fish habitat; however, MOE noted that amphibian species could be present in the area and could potentially be affected by the predicted concentrations of dissolved aluminum in the creek. In particular, MOE noted that concentrations of aluminum in Humphrey Creek were predicted to exceed the chronic guideline for the protection of aquatic life seasonally during operations and decommissioning and closure; exceedances of the acute guideline for the protection of aquatic life were predicted to occur in the spring for some years during these phases, which could potentially result in lethal effects on some aquatic life species. KAM noted that these concentrations were likely over-estimates and due to unrepresentative model interactions.

KAM disagreed with a number of MOE's conclusions regarding the potential effects to ecological receptors from changes to water quality, stating that MOE's assessment did not adequately consider duration and timing. In particular, KAM noted that elevated concentrations of many parameters are predicted to occur during December and January, when surface flows are typically low to non-existent in the creeks. During these months, the early life stages of aquatic life (upon which the aquatic guidelines are based) are typically not present and, therefore, the potential effect to aquatic life would be limited. KAM also noted that Humphrey Creek has not been confirmed as western toad aquatic breeding habitat, nor identified as potential breeding habitat. KAM indicated that Western Toad and other amphibians prefer still water rather than flowing water for breeding. While amphibians may use the edges of slow moving creeks, Humphrey Creek is a fast moving stream due to its gradient. KAM noted that the assumptions related to the solubility of aluminum in dust are conservative and likely overestimate the potential effect to water quality. However, KAM agreed that additional planning and testing would be required to develop more robust benchmarks/ guidelines before applying for permits, should Ajax proceed.

2.3.4 UPDATED WATER QUALITY PREDICTIONS

MOE, ECCC, and Indigenous groups requested updates to the water balance and water quality modelling to increase confidence in the predictions. KAM undertook several updates to the water balance model and water quality predictions during the review period that included updated inputs from the revised fish habitat offsetting plan, revised dustfall loadings from updated air quality results (refer to section 8), and assessment of the effects of climate change.

KAM's updated water quality predictions showed greater fluctuations in concentration of some parameters under low flow winter conditions in Peterson Creek, compared with the original predictions. In particular, the updated predictions resulted in higher concentrations of selenium and sulphate in lower Peterson Creek between Humphrey Creek and Long Lake road during low flow conditions. MOE indicated that the elevated sulphate concentrations could potentially have chronic effects on aquatic life and the aquatic food chain. For Jacko Lake and Humphrey Creek, the predicted concentrations remained fairly consistent compared to earlier iterations of the water quality model. Overall, KAM indicated that the revised water quality predictions were similar to those presented in the EIS/Application, and that the conclusions of the assessment remained unchanged.

2.3.5 EFFECTS OF THE EDITH LAKE FAULT ZONE ON SURFACE WATER QUALITY AND QUANTITY

ECCC, NRCan, MFLNR, SSN, the City of Kamloops, and members of the public were concerned that the Edith Lake fault zone could potentially act as a conduit for contact water from the tailings storage facility and mine rock storage facilities to Jacko Lake and degrade water quality. The Edith Lake fault zone is a northwest-southeast trending geological structure which underlies portions of Jacko Lake, the planned north embankment of the tailings storage facility, the west mine rock storage facility, and the south mine rock storage facility.

In response to the identified uncertainties related to the Edith Lake fault zone and groundwater movement at the site, KAM undertook additional sensitivity analyses to assess the effect of variations in the hydraulic conductivity of the Edith Lake fault zone. The results of the higher hydraulic conductivity simulations indicated that the increased groundwater discharge to Jacko Lake that included seepage-affected water from the tailings storage facility and west mine rock storage facility, could potentially impact water quality in Jacko Lake. However, KAM noted that this scenario would be unlikely to occur, since KAM would be able to detect changes in groundwater flow in the event that the hydraulic conductivity was higher than predicted, and would be able to adaptively manage the effect by implementing measures such as installation of interception wells, cut-off walls, horizontal drains, and grouting. KAM also indicated that groundwater movement through the Edith Lake fault zone in the base case is not predicted to affect water quality in Jacko Lake.

Section 3 of this Report provides additional details regarding the Edith Lake fault zone and the uncertainties regarding its potential influence on groundwater movement in the project area. In response to the uncertainties raised by reviewers, KAM committed to developing and implementing a Surface Water and Groundwater Management and Monitoring Plan that would include requirements for monitoring and applying additional measures to mitigate potential water quality effects to Jacko Lake from seepage-affected water, as necessary, based on monitoring results.

NRCan agreed that KAM's modeling has considered a conservative worst-case scenario for conductivity of the Edith Lake fault zone, and that the proposed monitoring and management program is likely to complement the numerical model capabilities to provide protection of water resources in the vicinity of Ajax.

2.3.6 CONSIDERATION OF GEOCHEMISTRY INPUTS TO THE WATER QUALITY PREDICTIONS

Members of the public, including the Kamloops Area Preservation Association, questioned the analytical methodology that KAM used to quantify levels of metals and other elements contained within rock at the Ajax site, and how this would affect water quality predictions from metal leaching/acid rock drainage. Technical advice from geochemistry specialists at MEMPR indicated that the methodology used by KAM was appropriate for Ajax and is the typical method employed for mining EAs.

The Sierra Club of BC and SSN raised concerns that KAM had underestimated the extent and severity of impacts to water quality in the Peterson Creek aquifer and questioned the kinetic testing methodology that KAM used to predict drainage chemistry from mine sources.[9] In response, KAM indicated that the drainage chemistry from the mine rock storage facilities and the tailings storage facility were determined from water samples recovered from kinetic leaching tests (both lab and field), as well as *in-situ* water samples from existing mine site features. The geochemical source terms were developed based on the predicted drainage chemistry and took into account the metal leaching potential of both potentially acid generating and non-potentially acid generating rock. KAM confirmed that full-scale mine data was used to validate the predicted water quality concentrations.

SSN disagreed with KAM's response, and raised continued concerns regarding the adequacy of the assessment methodology and predictions, in particular, the aqua-regia leach test method, the kinetic test methods, and the use of average annual concentrations in the water quality model. The Agency and EAO sought advice from MEMPR regarding these issues and their potential implications to the effects assessment. MEMPR indicated that the geochemical methods and approaches that KAM used to support the effects assessment for Ajax are consistent with MEMPR's policy guidance and generally-accepted industry practices.

Members of the public and SSN also expressed concern that KAM did not publicly release all their chemical assay results, stating that they are a key input to water quality and air quality modelling, and should be available for public consideration and review. KAM clarified that detailed assays and statistical summaries of the characteristics of the Ajax deposit were provided in the EIS/Application and that the information was based on the geological database that KAM developed for Ajax.

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[9] Ajax Project Review – Review of Predicted Water Contamination (prepared for Sierra Club of BC Foundation). Kevin A. Morin, Minesite Drainage Assessment Group. March 31, 2016 - presented as evidence at the SSN oral hearings in May 2016 as part of the SSN Assessment Process

MEMPR indicated that for EAs, mining proponents are required to provide average assay values and reserve information for the economic metals of interest. MEMPR also indicated that proponents are required to demonstrate that they have accurately characterized the metal content variability and central tendency for the different geologic units comprising the mine rock, tailings, ore, and other material stockpiles. KAM responded that this information was provided in the EIS/Application.

2.3.7 EFFECTS OF DUSTFALL ON WATER QUALITY

Dustfall is one of several inputs to the water quality model. MFLNR and MOE questioned how dust was included in the water quality model and whether the modelling assumptions were sufficiently conservative in this regard. KAM's dustfall inputs to the water quality model were based on the modelled dustfall concentrations from the air quality assessment using a 90% control efficiency for fugitive dust from haul roads. KAM incorporated the dustfall inputs by conservatively assuming that all dustfall loading was fully soluble in water, except for aluminum originating from the haul roads, mine rock, and ore, which was considered to be 50% soluble based on its geochemical characterization. MOE noted that the assumptions were sufficiently conservative for accounting for the contribution of dust deposition to water quality, and the City of Kamloops agreed the approach was appropriate; however, the City of Kamloops disagreed with method used for screening for contaminants of potential concern.

MOE and other reviewers noted that KAM proposed to use dust suppressants and surfactants on the tailings storage facility tailings beach and haul roads, as part of the updated Fugitive Dust Management Plan. Reviewers noted that the use of these chemicals could potentially affect water quality, and had not been accounted for in the water quality effects assessment. To address uncertainty related to the potential use of these chemicals and their effect on water quality, the EAO is proposing a condition that would require KAM to, in consultation with MOE, assess and mitigate the effects of any dust suppressants or surfactants required to mitigate fugitive dust at the site on water quality.

2.3.8 PROPOSED WATER QUALITY MONITORING AND MANAGEMENT

Members of the working group, including SSN, MOE, and ECCC, and the public stressed the importance of having a robust management and monitoring plan for water quality. SSN indicated that the conceptual surface water monitoring and management plan in the EIS/Application was not sufficient to detect biologically important changes in water quality. SSN indicated that the monitoring plan would need to be able to detect short-term, high-magnitude consequences (i.e. disasters) as well as longer-term, cumulative effects (i.e. trends). Members of the public, including the Aberdeen Neighbourhood Association and Kamloops Area Preservation Association, requested that KAM make water quality monitoring reports available to the public.

In response to these comments, KAM committed to undertaking additional studies to better understand how ecologically-relevant effects would be detected for water, fish and fish habitat, and wildlife and incorporating the additional data in relevant monitoring and management plans. KAM noted that continued monitoring would also provide additional data that would augment the baseline and enhance the ability of the water quality model to detect changes in water quality. KAM also committed to involving SSN in on-going review of existing water quality and water quantity programs and plans and to make monitoring data available to the public.

2.3.9 STREAMFLOW REDUCTIONS IN PETERSON CREEK AND STREAMFLOW MITIGATION STRATEGY

MFLNR, MOE, ECCC, DFO, SSN, the City of Kamloops, and members of the public expressed concerns with the predicted streamflow reductions in Peterson Creek and the potential impacts to related values, such as water quality, fish and fish habitat, water licence holders, and the spiritual and cultural values of the *Pípsell* area. Section 15 of this report discusses the potential effects to land and resource use, including impacts to water licence holders on Peterson Creek from predicted streamflow reductions. Part C of this Report discusses the spiritual and cultural values of *Pípsell* to SSN.

In response to requests from MFLNR, MOE, and the City of Kamloops, KAM provided updated predictions that addressed streamflows under average runoff conditions and 5-year return period dry conditions. During the review period, KAM discussed options for mitigating predicted streamflow losses in Peterson Creek with the MFLNR Water Stewardship Division (which has a regulatory role under the *Water Sustainability Act*), MOE, DFO, and SSN. KAM proposed a conceptual streamflow mitigation plan that provided a strategy for offsetting the predicted flow reductions in lower Peterson Creek by pumping water from Kamloops Lake into Jacko Lake. KAM indicated that this mitigation measure could make use of the conveyance system that KAM had already proposed as part of the project design to provide water for the processing plant, and that the predicted average annual deficit of 235,000 m^3 in lower Peterson Creek could be partially or fully offset. This would correspond to an hourly rate of approximately 27 m^3/h, which KAM indicated could be withdrawn within the 1,505 m^3/h maximum rate that KAM already proposed for Ajax activities. KAM indicated that further details regarding how and when this water would be introduced to the Peterson Creek system would be determined in consultation with MFLNR and SSN during the permitting stage, should Ajax proceed.

While KAM determined that pumping water from Kamloops Lake was a conceptually feasible approach for the construction, operations and decommissioning and closure phases, KAM and reviewers acknowledged that a long-term solution would be required for the post-closure phase. Accordingly, KAM committed to ensuring that water supply in Peterson Creek would be maintained for water licence holders with higher priority than KAM at post-closure. At a minimum, this would involve continued pumping from Kamloops Lake in the post-closure phase until a suitable alternative could be established. KAM noted that the long-term strategy could include a combination of diversion of water from Keynes Creek and Humphrey Creek and/or a transfer of water rights. KAM also committed to monitoring streamflow changes in Peterson Creek, verifying these against the predictions in the EIS/Application, and applying additional mitigation as necessary. This could include working with MFLNR to determine the appropriate mitigation measures necessary per the *Water Sustainability Act* and applicable policies and guidelines for future water licencing applications.

MFLNR indicated that maintaining current streamflow levels in Peterson Creek by supplementing with water pumped from Kamloops Lake appeared to be a conceptually technically feasible option for the operations phase, and indicated further details would be required during the permitting phase. However, MFLRN indicated that they were not supportive of a long-term approach that involved transferring water from Kamloops Lake to the Peterson Creek watershed during post-closure, due to uncertainties related to the maintenance of pumping infrastructure in perpetuity.

The expansion of the west arm of Jacko Lake (refer to discussion of revised fish habitat and fishery offsetting plan in section 4) could have adverse effects to licence holders with points of diversion upstream of the lake.

KAM committed to working with these water licence holders and MFLNR to amend their licences so that there would be no change in the timing or quantity of water allocation.

2.3.10 EFFECTS OF CLIMATE CHANGE ON WATER QUALITY AND QUANTITY

MFLNR, MOE, the City of Kamloops, and SSN raised concerns regarding the adequacy of climate change considerations in the EIS/Application, particularly in the assessment of effects on streamflows in lower Peterson Creek. MFLNR requested that KAM describe the water losses in Peterson Creek downstream of the mine, including effects of climate change. MOE requested that a representative climate change scenario be simulated for the water balance and water quality models to demonstrate the effects of potential climate change on the water quantity and water quality predictions. In response to these concerns, KAM undertook further evaluation of the potential effects of climate change on existing conditions. The results indicated that by the year 2085, climate change would cause annual runoff to increase by approximately 19% at Jacko Lake and 25% in lower Peterson Creek, compared to existing conditions. The water quality predictions for the climate change scenario resulted in some increases and some decreases in parameter concentrations compared to the base case water quality results; however, KAM indicated that the results supported the conclusions in the EIS/Application for water quality.

SSN raised concerns regarding the effects of the proposed water withdrawals from Kamloops Lake on the Thompson River system, particularly in consideration of climate change, and suggested that KAM assess impacts to salmon stocks, aquatic communities, and other species that may already be stressed. Members of the public also noted that the Thompson River was designated by the Outdoor Recreation Council of British Columbia as one of BC's endangered rivers in 2016 due to the state of the steelhead run and suggested that water licences and water extraction rates on the river's tributaries should be more closely monitored to ensure adequate flows remain for fish.

In response to these concerns, KAM wrote to the Province in March 2016 requesting that the British Columbia Government consider initiating a water stewardship study over the Kamloops Lake watershed, and expressed an interest in supporting this initiative should it proceed. In materials presented to SSN's review panel members on February 15, 2017, the Province proposed to undertake a pilot collaborative stewardship initiative with SSN in the Thompson River watershed. To support the work of stewardship initiatives, the Province offered to provide $100,000 in funding for the first year under the terms of an agreement. Refer to Part C of this report for further details.

KAM also assessed the effects of water withdrawal from Kamloops Lake and the Thompson River in consideration of climate change. For both average climate conditions and climate change conditions, KAM indicated that the effect would be negligible, as the maximum predicted reduction in average monthly flow and 10-year low monthly flow in the Thompson River at Savona was less than 0.25% and 0.33%, respectively.

2.3.11 USE OF CITY OF KAMLOOPS WASTEWATER EFFLUENT AS POTENTIAL MAKE-UP WATER FOR AJAX

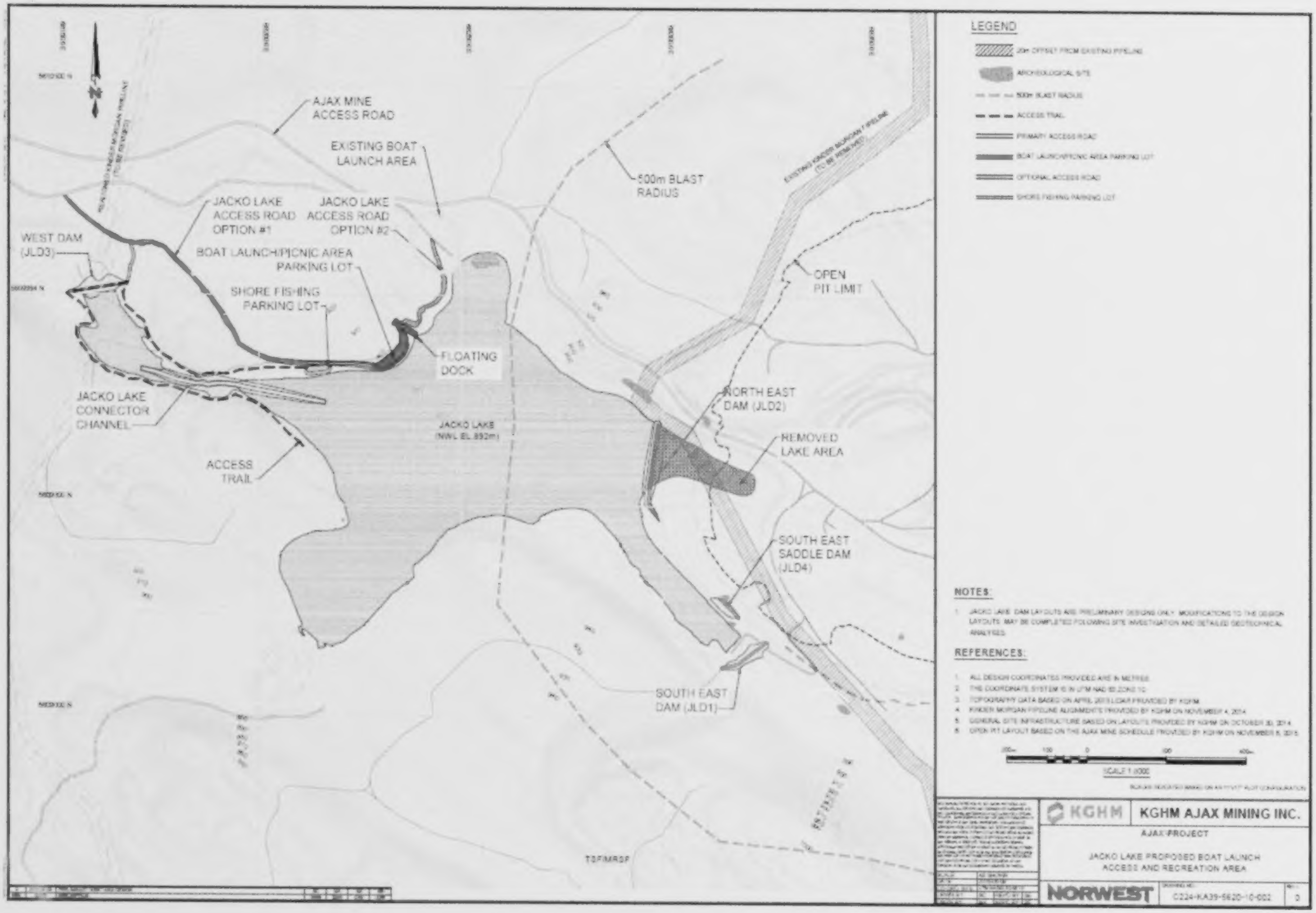
SSN requested that KAM consider alternative sources of freshwater for the mine. SSN recommended that wastewater effluent from the City of Kamloops be considered as a source of water to reduce the freshwater withdrawal requirements from Kamloops Lake.

KAM noted that the use of treated sewage effluent would not mitigate total water withdrawal from Kamloops Lake, since the treated effluent is currently discharged to the lake. However, KAM evaluated the feasibility of using effluent from the City of Kamloops Sewage Treatment Centre as process makeup water for the mine. The study indicated that there would be additional costs associated with the use of the treated effluent, as well as a substantial loss of metal recovery resulting from the use of treated effluent during ore processing. The study also showed that there would be additional environmental impacts related to the requirements for a second pipeline. Based on these findings, KAM concluded that the use of treated effluent was not an economically viable option for Ajax. The Agency and EAO are of the view that KAM has adequately assessed the feasibility of using City of Kamloops effluent as potential makeup water for the mine.

2.3.12 EFFECT OF JACKO LAKE DAMS ON WATER QUANTITY

MFLNR, DFO, and ECCC raised questions regarding the range of variability in Jacko Lake water levels with the construction of the Jacko Lake dams (refer to Figure 3 below). Reviewers questioned how lake level fluctuations could affect existing littoral habitats and the downstream flow regime on Peterson Creek. MFLNR also noted that a dam breach analysis and inundation study at the southeast dam on Jacko Lake would be required, and that the updated design of the Peterson Creek diversion system could increase the consequence rating of this dam.

Figure 3: Jacko Lake Dams


AJAX MINE ACCESS ROAD
EXISTING BOAT LAUNCH AREA
JACKO LAKE ACCESS ROAD OPTION #1
JACKO LAKE ACCESS ROAD OPTION #2
WEST DAM (JLD3)
BOAT LAUNCH/PICNIC AREA PARKING LOT
SHORE FISHING PARKING LOT
FLOATING DOCK
JACKO LAKE CONNECTOR CHANNEL
ACCESS TRAIL
JACKO LAKE (NWL EL 892m)
500m BLAST RADIUS
OPEN PIT LIMIT
NORTH EAST DAM (JLD2)
REMOVED LAKE AREA
SOUTH EAST SADDLE DAM (JLD4)
SOUTH EAST DAM (JLD1)
LEGEND
20m OFFSET FROM EXISTING PIPELINE
ARCHEOLOGICAL SITE
500m BLAST RADIUS
ACCESS TRAIL
PRIMARY ACCESS ROAD
BOAT LAUNCH/PICNIC AREA PARKING LOT
OPTIONAL ACCESS ROAD
SHORE FISHING PARKING LOT
NOTES:
1. JACKO LAKE DAM LAYOUTS ARE PRELIMINARY DESIGNS ONLY. MODIFICATIONS TO THE DESIGN LAYOUTS MAY BE COMPLETED FOLLOWING SITE INVESTIGATION AND DETAILED GEOTECHNICAL ANALYSES.
REFERENCES:
1. ALL DESIGN COORDINATES PROVIDED ARE IN METRES.
2. THE COORDINATE SYSTEM IS IN UTM NAD 83 ZONE 10.
3. TOPOGRAPHY DATA BASED ON APRIL 2013 LIDAR PROVIDED BY KGHM.
4. KINDER MORGAN PIPELINE ALIGNMENTS PROVIDED BY KGHM ON NOVEMBER 4, 2014.
5. GENERAL SITE INFRASTRUCTURE BASED ON LAYOUTS PROVIDED BY KGHM ON OCTOBER 30, 2014.
6. OPEN PIT LAYOUT BASED ON THE AJAX MINE SCHEDULE PROVIDED BY KGHM ON NOVEMBER 5, 2015.
200m 100 0 100 400m
SCALE 1:4000
KGHM
KGHM AJAX MINING INC.
AJAX PROJECT
JACKO LAKE PROPOSED BOAT LAUNCH ACCESS AND RECREATION AREA
NORWEST
C224-KA39-5620-10-002
2

Source: Memo 0706_KAM_Fish Habitat and Fishery Offsetting Plan, KAM, July 2016.

KAM indicated that the normal operating level of Jacko Lake would remain at 892 m above sea level. The dams would be designed to contain a large precipitation event and would provide protection against flooding. The design crest elevation of the proposed dams is 895.5 m above sea level, which would provide a storage capacity greater than twice the estimated Probable Maximum Flood levels. During heavy precipitation events, controlled releases of water from Jacko Lake would help limit potential impacts to riparian and shoreline areas. The increased lake storage would also provide additional water supply in wet years that could result in a longer duration of increased streamflow throughout the irrigation and low flow seasons to better meet environmental flow needs for fish and other aquatic organisms. The timing and rate of release from Jacko Lake would continue to be regulated by MFLNR and operated by the water bailiff to ensure flow requirements for downstream water licence holders, as well as ecological needs. The EAO notes that the additional storage capacity that would be created in Jacko Lake by Ajax would require an authorization from MFLNR under the *Water Sustainability Act*.

2.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

2.4.1 SURFACE WATER QUALITY

In consideration of KAM's proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in the following residual effects to surface water quality:

- **Humphrey Creek:** Increase in concentrations of some metals in Humphrey Creek (i.e. aluminum, arsenic, copper, iron, molybdenum, and selenium), as well as nitrate, resulting from potential seepage of contact water from the south mine rock storage facility surfacing in Humphrey Creek, surface runoff from the reclaimed tailings storage facility and the reclaimed south mine rock storage facility in the post-closure phase, and potential loading from dustfall.
- **Lower Peterson Creek:** Increase in concentrations of some metals in lower Peterson Creek (i.e. aluminum, antimony, arsenic, copper, iron, molybdenum, selenium, and uranium), as well as sulphate, chloride, and nitrate, resulting from potential seepage and runoff of contact water from the south, west and east mine rock storage, as well as potential loading from dustfall.

The Agency and EAO do not anticipate residual adverse effects to Jacko Lake water quality, since predicted water quality concentrations in the lake did not exceed applicable guidelines or current background concentrations.

The Agency and EAO's assessment of residual effects considers the results of the base case water quality predictions, as well as the sensitivity scenarios and their likelihood of occurrence, in order to determine the range of potential residual effects. The Agency and EAO compared predicted water quality concentrations with applicable guidelines and preliminary site-specific benchmarks, where appropriate, to characterize the magnitude of effects. The generic guidelines and some of the proposed benchmarks are designed to protect aquatic organisms, wildlife, livestock and irrigation water uses, and the guidelines include an uncertainty factor. The Agency and EAO note that KAM's proposed water quality benchmarks are preliminary and would require further refinement and investigation in consultation with MOE during the permitting phase, should Ajax proceed.

In Humphrey Creek, the Agency and EAO consider the residual effect from predicted selenium concentrations to be high in magnitude. Baseline selenium concentrations in Humphrey Creek currently exceed the generic water quality guidelines. Concentrations of selenium are predicted to exceed the generic guidelines and the baseline range seasonally under low flow conditions in the operations and post-closure phases. The low flows during these periods reduce the likelihood that there would be effects to ecological receptors. However, the Agency and EAO note that selenium can bio-accumulate in the sediment and move up the food chain, and there are uncertainties with respect to the potential related effects on ecological receptors. While Humphrey Creek is not considered fish habitat, it supports amphibians and invertebrates.

High magnitude effects are also predicted for aluminum in Humphrey Creek, since exceedances of the chronic guidelines for the protection of aquatic life are predicted to occur seasonally during operations, decommissioning and closure. Exceedances of the acute guideline for the protection of aquatic life are also predicted to occur in the spring in some years during these phases, which could affect invertebrates and amphibians in the creek, including potentially lethal effects on some aquatic life species. The Agency and EAO consider that amphibians may use the edges of slow moving creeks for habitat, but that the gradient of Humphrey Creek makes it a faster moving stream and potentially less desirable habitat for amphibians. While the effects due to aluminum are predicted to be high magnitude, the Agency and EAO consider that effects to amphibians and invertebrates are not likely to occur on a population level. The Agency and EAO also note that the modelled predictions are based on maximum predicted concentrations and represent conservative estimates of potential concentrations.

In lower Peterson Creek, the Agency and EAO consider the residual effects from elevated selenium and sulphate concentrations to be high in magnitude, as the concentrations of these parameters are predicted to measurably exceed the maximum BC water quality guidelines for the protection of aquatic life under most scenarios and sensitivity cases, and could affect the growth and reproduction of aquatic life. Baseline concentrations of sulphate and selenium are also elevated in Peterson Creek and exceed applicable guidelines under low flow conditions when groundwater is a more dominant component of the flow. Concentrations of these parameters are predicted to seasonally exceed the generic guidelines throughout all project phases.

For some areas of lower Peterson Creek, selenium concentrations are predicted to seasonally exceed water quality guidelines for the protection of aquatic life during operations, and are predicted to be particularly high in the spring. These exceedances tend to correlate to months when there is little to no predicted visible surface flow (only subsurface flow). As well, the habitat in Lower Peterson creek is of marginal value, and it is highly unlikely that fish in this section of the creek are currently able to carry out life processes important for the maintenance of a viable population. The Agency and EAO consider that this reduces the likelihood that there would be effects to aquatic life, livestock, or wildlife. However, due to the potential for selenium to bio-accumulate in the food chain and the duration and timing for which the elevated concentrations occur, there are uncertainties with respect to the potential effects on ecological receptors from the elevated concentrations. The Agency and EAO also note that the modelled predictions are based on maximum predicted concentrations and represent conservative estimates of potential concentrations.

For chloride, the Agency and EAO consider the residual effect in Peterson Creek to be medium magnitude, since concentrations of chloride in Peterson Creek are predicted to seasonally exceed the BC water quality guidelines for the protection of aquatic life and for irrigation. The Agency and EAO note that there could be potential effects to plants that are sensitive to chloride if they were irrigated with this water; however, the effect would likely be limited since the highest concentrations of chloride are predicted to occur predominantly during the winter months when there would likely be insufficient flows to support irrigation withdrawals from Peterson Creek.

The residual effects associated with predicted concentrations of copper, arsenic, iron, and nitrate in lower Peterson Creek and Humphrey Creek are considered to be medium magnitude, as these parameters were predicted to exceed BC water quality guidelines for the protection of aquatic life in some, but not all sensitivity cases. Similarly, for lower Peterson Creek, medium magnitude effects were predicted for aluminum, antimony, and uranium. The Agency and EAO consider that the predicted concentrations of these parameters under some sensitivity scenarios could potentially affect growth and reproduction of aquatic life (fish and its food chain) in Peterson Creek. The Agency and EAO acknowledge, however, that some of these concentrations would occur when surface flows are low to non-existent, such as during the winter, when aquatic productivity is low, which would limit the potential effects to aquatic life. Humphrey Creek is not considered fish habitat, which would limit the potential aquatic life effects; however, Humphrey Creek is habitat for amphibians and other aquatic life.

Exceedances of the BC water quality guideline for wildlife and livestock are predicted for molybdenum in both Peterson Creek and Humphrey Creek throughout the life of Ajax and in some sensitivity scenarios. The Agency and EAO consider this effect to be of medium magnitude and note that the elevated molybdenum levels could potentially affect wildlife and livestock.

The Agency and EAO acknowledge that there are uncertainties related to the long-term management of predicted streamflow losses in Peterson Creek. The Agency and EAO acknowledge that KAM's conceptual plan to augment flows in lower Peterson Creek with water pumped from Kamloops Lake would likely improve water quality conditions in Peterson Creek because of generally higher water quality in Kamloops Lake and increased flow.

The Agency and EAO note that there are regulatory requirements under the *Environmental Management Act* and *Mines Act* for water quality management and monitoring both on and off of the mine site, and reporting that would form part of the permitting processes following the EA, should Ajax proceed. The EAO would work closely with other provincial regulatory authorities on any complementary monitoring and management requirements, and the compliance and enforcement of those requirements. KAM has also committed to undertaking monitoring, follow-up, and adaptive management as necessary to ensure KAM complies with the *Fisheries Act* and reporting requirements of the *Metal Mining Effluent Regulations*. To support an overall regulatory management framework for water quality for Ajax and to address uncertainties with respect to the predicted water quality effects, the EAO is proposing the following conditions related to surface water quality:

- Development and implementation of a Construction Environmental Management Plan, which would include requirements for spill prevention and response, and sediment and erosion control measures; and

- Development and implementation of a Surface Water Quality Management and Monitoring Plan, which would outline measures for minimizing effects to surface water quality and would address monitoring, verification of predicted effects, and adaptive management strategies, including related to the effects of any dust suppressants or surfactants on water quality.

In consideration of the above, the Agency and EAO consider that the adverse residual environmental effects of Ajax on surface water quality would range from medium to high magnitude, depending on the parameter. The effects to surface water quality would be irreversible because they would not return to pre-mining baseline conditions, but would decrease in magnitude with time, since reclamation of mine facilities would reduce the source loading which would partially reverse the effects. The duration of effects to surface water quality would be far future, persisting beyond the closure phase of Ajax. The effects would occur within the Peterson Creek watershed; for Humphrey Creek, they would be more localized and would occur approximately within 500 m of Ajax facilities.

The Agency and EAO's characterization of the residual effects of Ajax on surface water quality, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

2.4.1.1 *Cumulative Effects*

The Agency and EAO are of the view that past and present projects and activities, including runoff and seepage from residential properties, roads and highways, rangeland, and the sand and gravel quarry located adjacent to Peterson Creek, could contribute to cumulative effects on surface water quality in the regional study area. Contributions from these past and present sources were captured by KAM in its description of baseline conditions. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual adverse effects discussed above.

The Agency and EAO are of the view that increased runoff from growth and expansion of the City of Kamloops in the future could potentially add to the predicted change in concentrations of parameters caused by Ajax. The additive effect of future increased runoff from the City of Kamloops in combination with the residual effects of Ajax could result in a cumulative effect to water quality downstream of Ajax. The Agency and EAO are of the opinion that the cumulative effect would be medium in magnitude, since the increase in parameter concentrations compared to past activities and future runoff from growth of the City of Kamloops is expected to be minor.

2.4.1.2 *Conclusion*

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to surface water quality.

Taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to surface water quality.

2.4.2 SURFACE WATER QUANTITY

In consideration of KAM's proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in the following residual effects to surface water quantity:

- Reduced streamflows in Peterson Creek, both upstream and downstream of Jacko Lake; and reduced inflows to Jacko Lake during all project phases.

KAM's proposed streamflow mitigation plan for maintaining baseline streamflows in Peterson Creek is currently at a conceptual level and involves pumping water from Kamloops Lake during construction, operations, decommissioning and closure. Further development of this mitigation plan would be required in the permitting phase to develop a long-term solution that does not require continued pumping from Kamloops Lake in the post-closure phase in order to mitigate impacts to water licence holders and ecological values such as fish and fish habitat from streamflow losses. The Agency and EAO note that there are regulatory requirements under the *Water Sustainability Act* for the management, protection and use of surface water resources, as well as regulatory requirements under the *Fisheries Act* for the protection of fishery resources and fish habitat.

To address uncertainties related to the long-term mitigation of streamflow losses in Peterson Creek and to support an overall regulatory management strategy for water quantity at Ajax, the EAO is proposing the following condition:

- Development and implementation of a Water Management and Hydrometric Monitoring Plan that would outline long-term water management strategies for Ajax that would address ecological flow needs and describe how water supply would be maintained for existing water licence holders on Peterson Creek and Jacko Lake, including options that do not involve pumping from Kamloops Lake in post-closure. KAM would be required to describe the approach to monitoring and adaptive management.

The Agency and EAO consider that the adverse residual environmental effects of Ajax on surface water quantity would be low in magnitude, since streamflow mitigation would be expected to maintain near baseline streamflow levels in Peterson Creek. The effect would be limited to the Peterson Creek watershed, and would be irreversible given the permanency of mine facilities that would cause the effect. For Kamloops Lake and the Thompson River system, the Agency and EAO consider that there would be negligible residual effects under both average climate conditions and also taking into account climate change, as the maximum predicted reduction in average monthly flow and 10-year low monthly flow in the Thompson River at Savona is less than 0.25% and 0.33%, respectively. The effect would be reversible once pumping ceased.

The Agency and EAO's characterization of the potential residual effects of Ajax on surface water quantity, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

2.4.2.1 *Cumulative Effects*

The Agency and EAO are of the view that past and present projects and activities, including water use from ranching and agricultural activities, could contribute to cumulative effects on surface water quantity in the regional study area. Contributions from these past and present activities were captured by KAM in its description of baseline conditions. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual adverse effects discussed above.

The Agency and EAO are of the view that water withdrawal from Kamloops Lake by the New Afton Mine, could potentially add to the predicted streamflow reductions in Kamloops Lake and the Thompson River system caused by Ajax. The combined effect of Ajax and the New Afton Mine withdrawing water from Kamloops Lake could result in a cumulative reduction of streamflow in Kamloops Lake of less than 0.35% for both the average monthly flows and 10-year monthly low flows. The Agency and EAO are of the opinion that the cumulative effect would be low in magnitude, since the reductions in streamflow from past and present activities, and future increased water withdrawal from the New Afton Mine are expected to be within the range of natural variation.

2.4.2.2 *Conclusion*

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to surface water quantity. The Agency and EAO acknowledge that there are uncertainties related to the effectiveness of a feasible long-term management strategy for streamflow losses in Peterson Creek that does not involve pumping from Kamloops Lake in the post-closure. Should Ajax proceed, monitoring and management of streamflows in Peterson Creek would be required throughout the life of Ajax to meet ecological needs and to maintain water supply for water licence holders. The EAO's proposed condition for surface water quantity includes requirements for follow-up monitoring and adaptive management related to the long-term management of streamflows in Peterson Creek.

Taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to surface water quantity.

3 Groundwater Quality and Quantity

3.1 BACKGROUND

This section provides a summary of the assessment of potential effects of Ajax on groundwater quality and quantity as identified by KAM, the mitigation measures proposed by KAM to address those effects, and a discussion of the key groundwater quality and quantity issues raised during the EA. It also sets out the analysis and conclusions of the Agency and EAO related to the potential adverse effects of Ajax on groundwater quality and quantity.

Changes in groundwater quality can affect surface water quality, human health, land and resource use, and Aboriginal Interests. The results of this assessment inform the following assessments: Surface Water (section 2), Human Health (section 10), Land and Resource Use (section 15), and Aboriginal Interests (Part C).

In BC, water quality is assessed through comparison of predicted or measured concentrations with established Approved and Working Water Quality Guidelines[10] based on the potential water uses.

The BC *Water Sustainability Act* is the principal law in BC for managing the diversion and use of water resources and informed the assessment of the potential effects of Ajax on groundwater. The *Water Sustainability Act* provides tools for protecting, managing and using water efficiently throughout the province.

3.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

3.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

Groundwater inflows, spring melt, and precipitation sustain evaporative lakes in the regional study area. Outside of spring freshet, creek flows are primarily sustained by groundwater recharge. While water quality guidelines for the protection of aquatic life are not directly applicable to groundwater, KAM used them as a basis for examining changes to water quality, since groundwater baseflows are an important contributor to streamflows in the regional study area. Groundwater quality influences water quality in surface waters, which may affect aquatic life in those water bodies.

There are 13 mapped aquifers in the regional study area, five of which are located within the local study area. Hydraulic conductivity, the ability for water to move through pores or fractures, varies considerably within the regional study area (by approximately 8 orders of magnitude). KAM identified several geological features that are considered to either act as barriers to groundwater flow, or areas where hydraulic conductivity is potentially enhanced (e.g. the Edith Lake fault zone).

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[10] MOE. British Columbia Approved and Working Water Quality Guidelines. Available at: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines

The Edith Lake fault zone is a northwest-southeast trending fault structure that underlies portions of Jacko Lake, and the planned north embankment of the tailings storage facility, the west mine rock storage facility, and the south mine rock storage facility. The fault is overlain by low hydraulic conductivity glacial till throughout much of its extent. There is uncertainty regarding the thickness of surficial deposits (i.e. glacial till and low hydraulic conductivity lakebed materials) beneath Jacko Lake; KAM estimated the lake bed thickness to range from a minimum of 0.15 m to 29 m or greater. Figure 4 below shows the interpreted location of the Edith Lake fault zone.

In the Peterson Creek watershed, groundwater discharges at the existing pits within the Ajax footprint and at the low-lying area near the confluence of Peterson Creek and Jacko Lake. The water elevation in the historical open pits remains well below the natural ground level and the surrounding measured groundwater levels; therefore there are no suspected discharges from these pit lakes. From there, KAM's regional mapping indicates that groundwater flows in either a northwesterly direction from Jacko Lake or an easterly direction following the Peterson Creek drainage. To the north of the mine site, KAM identified a ridge system that is interpreted to coincide with a groundwater divide, resulting in groundwater flowing either to the south (i.e. towards the mine site) or to the north (towards Aberdeen). The Aberdeen area, which is located approximately 3 km to the north of Ajax, has a history of slope stability issues that are affected by existing and historical irrigation practices (both municipal and residential). The City of Kamloops currently manages the issue by actively pumping from groundwater wells in the area to lower the groundwater table.

Groundwater in the regional study area is used for domestic purposes, irrigation, and livestock watering. There are 495 registered wells in the regional study area, the majority of which are used for private domestic water. Within the local study area, KAM notes there are approximately 54 wells, four of which are within 2 km of the Ajax footprint. There are no registered wells within the Ajax footprint.

KAM characterized the baseline groundwater quality conditions by comparing measured concentrations of parameters to the most stringent applicable water quality guidelines based on the potential water use.[11]

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[11] This includes the British Columbia MOE Approved and Working Water Quality Guidelines (for drinking water supply, fresh water aquatic life (maximum and 30-day average), livestock water supply, irrigation and recreation), the Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines (for the protection of aquatic life (freshwater), agriculture (livestock), agriculture (irrigation) and wildlife), and HC

The baseline groundwater quality and quantity characteristics for the project area were described by KAM as follows:

- Groundwater in the region is generally alkaline, hard to very hard, and high in dissolved solids. Total dissolved solids and pH commonly exceeded BC drinking water quality guidelines;
- Major ions and nutrients: Sulphate concentrations are generally elevated in groundwater samples from throughout the study area and frequently exceeded BC livestock and drinking water quality guidelines. The highest sulphate concentrations were found near local groundwater discharge areas such as the previously-mined open pits within the Ajax footprint, Inks Lake, and Peterson Creek. Fluoride is also elevated throughout the project area and frequently exceeded the BC livestock water use guidelines and aquatic life guidelines, as well as the drinking water quality guidelines. The highest concentrations of fluoride were found near the proposed open pit location. Exceedances of the drinking water quality guidelines were also common for sodium. Occasional exceedances of the drinking water quality guidelines were observed for nitrate and ammonia;
- Metals: Concentrations of arsenic, boron, iron, manganese, molybdenum, and selenium in groundwater from the project area regularly exceeded the BC guidelines for the protection of aquatic life. Occasional or infrequent exceedances of the aquatic life guidelines were noted for aluminum, antimony, cadmium, chromium, cobalt, copper, mercury, uranium and zinc. Concentrations of manganese commonly exceeded the drinking water quality guidelines. Occasional exceedances of the drinking water quality guidelines were noted for arsenic, selenium, and uranium. Concentrations of molybdenum commonly exceeded the livestock water use guidelines. Occasional exceedances of the livestock water use guidelines were noted for arsenic. Concentrations of manganese and molybdenum commonly exceeded the irrigation water use guideline. In general, KAM noted that the distribution of metal concentrations appeared to be influenced by local geological enrichment in specific minerals (and hence proximity to the proposed open pit);
- Groundwater levels near Ajax vary annually from <0.1 m to approximately 4 m, and are typically highest in the summer months; and
- The overall regional groundwater balance is dominated by recharge from infiltration of precipitation and snowmelt, and discharge by evapotranspiration. Precipitation in the region is

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Guidelines for Canadian Drinking Water Quality and Recreational Water Quality. Collectively, these are referred to as the "generic guidelines."

limited and evaporation rates are high; therefore, regional groundwater recharge rates are interpreted to be low.

3.2.2 POTENTIAL EFFECTS TO GROUNDWATER QUALITY AND MITIGATION MEASURES

KAM indicated that water, such as rainfall and snowmelt, coming in contact with project components, such as the mine rock storage facilities and the tailings storage facility, could potentially be affected by these materials and cause metals to leach from them. This contact water (i.e. water that has been affected through contact with mine facilities) could then seep into the groundwater system. KAM also indicated that fugitive dust from project activities could settle onto local surface water bodies, which could potentially degrade surface water quality; the impacted surface water could then seep into the groundwater system.

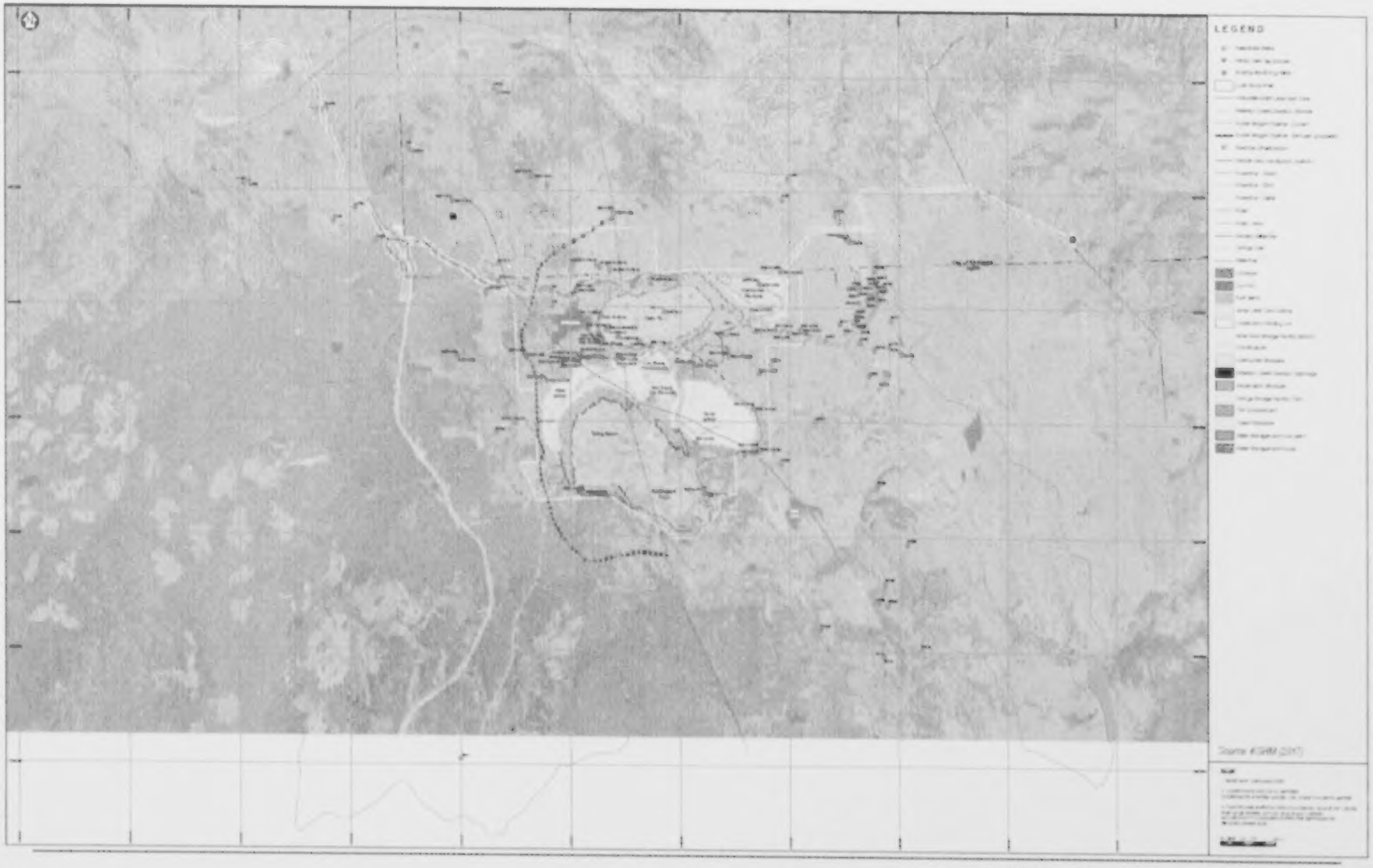
KAM indicated that the proposed mitigation measures for groundwater quality are the same as for surface water quality because the sources of potential effects are the same (see section 2).

In addition, KAM identified potential mitigation options that could be implemented if conductivity of the Edith Lake fault zone is higher than predicted (and if seepage quantities and concentrations potentially of concern to the downgradient receiving environment are encountered during monitoring). These measures include (but are not limited to):

- Source removal or treatment (e.g., in this case changes to the mineral extraction process or amendments added to the tailings storage facility pond water to lower concentrations of contaminants in supernatant water);
- Quantitative risk assessment for the specific receiving environment at risk (i.e., evaluation of the receiving environment and biota at risk compared to the contaminant concentrations anticipated at that location, assessment of the exposure pathways);
- Source interception (e.g. seepage interception ponds, wells or trenches);
- Passive remediation approach (e.g. treatment wetland); and
- Migration pathway control (e.g., grouting to reduce hydraulic conductivity and limit or eliminate migration potential).

These conceptual mitigation options could be considered following detailed site investigations as part of monitoring and adaptive management, in order to identify which option (or if other options) would be most appropriate.

Figure 4: Edith Lake Fault Zone



Source: KAM's response to EAO request, April 2017

3.2.3 PROPONENT'S CONCLUSIONS ON RESIDUAL EFFECTS TO GROUNDWATER QUALITY

KAM determined that RES-2 was the nearest residential well installed within the Peterson Creek aquifer downgradient of proposed mine infrastructure. Refer to Figure 5 for the location of the RES-2 well, which is approximately 2 km to the southeast of the east mine rock storage facility. KAM compared modelled/predicted concentrations of parameters at RES-2 to existing baseline conditions and the most stringent applicable water quality guidelines for potential water uses (see Table 8 below). KAM indicated that Ajax could result in increased concentrations of fluoride, sulphate, copper, iron, manganese, molybdenum, and zinc in groundwater at the RES-2 residential well. KAM indicated that the duration of these effects would persist into the post-closure phase.

Table 8: Summary of Predicted Groundwater Quality Exceedances[12] at RES-2

Guideline	Status
Drinking Water Guidelines	• No exceedances of health-based guidelines • Exceedances of aesthetic objectives[13] for: ○ Sulphate (baseline and predicted) ○ Iron (baseline and predicted) ○ Manganese (predicted concentrations only)
Irrigation Water Use Guidelines	• Molybdenum and manganese exceedance in both the baseline and predicted concentrations
Livestock Watering Guidelines	• Sulphate exceedance in both the baseline and predicted concentrations
Aquatic Life Water Quality Guidelines[14]	• Exceedances in both the baseline and predicted concentrations: ○ Fluoride ○ Sulphate ○ Copper ○ Iron ○ Zinc

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[12] Exceedances were determined by comparing predicted concentrations with the most stringent applicable water quality criteria from: the BC MOE Approved and Working Water Quality Guidelines (for drinking water sources, fresh water aquatic life (maximum and 30-day average), livestock water supply, irrigation and recreation), the Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines (for the protection of aquatic life (freshwater), agriculture (livestock), agriculture (irrigation) and wildlife), and HC Guidelines for Canadian Drinking Water Quality and Recreational Water Quality.

[13] Aesthetic objectives relate to the smell and taste of drinking water; they also address potential for staining of laundry and plumbing. They are not health-based.

[14] Aquatic Life Water Quality Guidelines are specific to the surface water environment; however, they are a useful comparison for systems that are dominated by groundwater flow and are generally considered the most restrictive of the guidelines.

KAM predicted that the greatest change from baseline conditions would be for manganese and molybdenum. KAM predicted that Ajax would cause these parameters to increase by 39% and 47%, respectively, from baseline conditions. The maximum predicted concentration of manganese would slightly exceed the aesthetic drinking water objectives, and the maximum predicted concentration of molybdenum would slightly exceed the BC irrigation guidelines. For sulphate, KAM predicted that concentrations would exceed all relevant guidelines, but noted that concentrations of sulphate also exceeded relevant guidelines under baseline conditions. KAM predicted that Ajax could cause sulphate concentrations to increase by a maximum of 4% from baseline conditions.

3.2.4 Potential Effects to Groundwater Quantity and Mitigation Measures

KAM developed and applied a three-dimensional numerical groundwater flow model, including sensitivity analyses, to assess the potential effects to groundwater quantity for all project phases. The modelling indicated that Ajax would result in changes in groundwater elevation in the local study area. Near the open pit, groundwater elevations would decrease due to development of the open pit, including pit dewatering and pit slope depressurization. The open pit would alter the groundwater flow patterns and act as a permanent groundwater discharge zone over the life of the project. In the decommissioning and closure and post-closure phases, the open pit would fill with groundwater discharge and surface water runoff, creating a permanent "pit lake." Near the tailings storage facility, groundwater elevations would increase due to deposition of saturated tailings and the formation of a tailings pond. These changes in groundwater elevations would alter the flow of groundwater in the vicinity of Ajax, causing it to flow from the tailings storage facility to the open pit. KAM predicted that there would be no net increase in groundwater levels in Aberdeen.

KAM indicated that there would be increased seepage losses to the groundwater flow system from upper Peterson Creek and Jacko Lake. At Jacko Lake, the seepage losses would go to the open pit and would result in decreased net average annual flows (surface water and groundwater) from the lake by approximately 5%. In lower Peterson Creek, KAM indicated that there would be overall less groundwater discharging to the creek, which would decrease baseflows by 9%. However, KAM noted a large degree of uncertainty associated with this estimate due to uncertainties related to the hydrogeologic properties of the area, including features such as the Edith Lake fault zone (see Figure 4).

KAM noted that most of the mitigation measures for groundwater quantity are the same as for surface water quantity (refer to section 2) and are built into the design of Ajax. A key mitigation measure proposed by KAM specific to groundwater quantity is as follows:

- Deepening or relocating private groundwater supply wells within 2 km of the open pit, should project-related changes to the groundwater balance affect the productivity of these wells.

3.2.5 PROPONENT'S CONCLUSIONS ON RESIDUAL EFFECTS TO GROUNDWATER QUANTITY

After mitigation, KAM predicted that the residual effects to groundwater quantity from Ajax would consist of a change in the local groundwater balance that would extend up to approximately 2 km from mine infrastructure and would include:

- Changes[15] in groundwater elevation within 2 km of mine infrastructure; and
- Changes in groundwater recharge and discharge within 2 km of mine infrastructure.

KAM indicated that the residual effects would also include an overall decrease in baseflows in Peterson Creek, as well as seepage from Jacko Lake to the groundwater system that would discharge to the open pit. These effects are discussed in the surface water quantity assessment (see section 2).

Near the open pit, KAM predicted that groundwater elevations would be approximately 100 m lower post-closure, compared to existing conditions. The open pit would act as a permanent groundwater discharge zone and would slowly fill with water, creating a pit lake. At post-closure, the initial pit lake level would be approximately 500 m above sea level (masl) and, over a period of 700 to 800 years, would increase to 760 masl, which is approximately 134 m below the proposed pit rim and Jacko Lake. The pit lake would be approximately 210 m lower than existing conditions. The predicted changes in groundwater elevations could reduce well productivity (i.e. the availability of water) within 2 km of the open pit during operations through to post-closure. The four private groundwater supply wells that are located within 2 km of the open pit would potentially need to be relocated or deepened, if affected by Ajax, in order to ensure adequate water supply for these potentially affected groundwater users.

Under the tailings storage facility, KAM predicted that groundwater elevations would be approximately 100 m higher post-closure, compared to existing conditions. In the decommissioning and closure phase, the tailings storage facility would be reclaimed with a dry cover, which would decrease infiltration and cause the groundwater mound below the facility to subside over time. KAM indicated that seepage from the tailings would be reduced once the tailings reached a generally unsaturated (consolidated) state.

3.2.6 CUMULATIVE ENVIRONMENTAL EFFECTS (GROUNDWATER QUALITY AND QUANTITY)

KAM stated that agriculture, ranching, and city growth have the potential to contribute to cumulative effects on groundwater quantity. KAM determined that agriculture and ranching activities within 2 km of the mine site could alter the local groundwater balance and potentially add to the changes in water balance and groundwater elevation caused by Ajax. KAM indicated that mitigation for cumulative effects from agriculture and ranching within 2 km of project facilities could include deepening or relocating affected wells and further consideration of Ajax's contribution to the effects in water management planning for local groundwater resources.

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[15] KAM defined "change" as at least a 1 meter change from existing conditions.

City of Kamloops growth may also change the groundwater balance from current conditions, but the effects are expected to be limited to areas within or immediately adjacent to City limits. KAM indicated that cumulative effects to groundwater elevation due to city growth are not expected to require mitigation.

KAM stated that the New Afton Project and the historical Afton tailings storage facility are located within the Cherry Creek watershed and, therefore, any seepage to groundwater from those projects does not interact with Ajax and would not contribute to cumulative effects to groundwater quantity or quality.

KAM addressed cumulative effects to groundwater quality through the assessments of surface water quality and human health. Refer to sections 2 and 10, respectively, for details.

3.2.7 MONITORING AND FOLLOW-UP (GROUNDWATER QUALITY AND QUANTITY)

KAM committed to verify the water quality and quantity effects predictions and the effectiveness of mitigation measures by developing and implementing a Surface Water and Groundwater Monitoring and Management Plan. Under this plan, KAM would monitor groundwater and surface water to detect changes to groundwater elevations and baseflow contributions to streams near the project area. KAM provided a preliminary conceptual version of this plan for the EA, and indicated that it would be updated to include additional details that are required for the permitting phase, should Ajax proceed.

KAM also committed to undertaking additional hydrogeological investigations, including pumping tests in the vicinity of the Edith Lake fault zone and Jacko Lake in support of development of permit applications. These additional investigations would aim to address uncertainties regarding the extent and properties of the Edith Lake fault zone and the movement of groundwater in these areas. The additional data from these studies would be used to update the conceptual and numerical groundwater models and the numerical groundwater flow predictions (with updates throughout the life of mine as needed). The updated groundwater model predictions would then be used to inform updates to the Surface Water Management and Monitoring Plan and support development of permit applications. In addition, KAM identified potential adaptive management steps that could be implemented as part of the follow-up monitoring program. These actions may include:

- Confirmation of trigger concentration (i.e., re-sample);
- Notification of the appropriate agencies that a trigger has been exceeded;
- Risk assessment to evaluate if seepage loadings and migration rates pose a risk to the receiving environment and an assessment of the time available during which a mitigation approach may be enacted (i.e., days, months or years);
- Selection and implementation of an appropriate mitigation strategy; and
- Additional monitoring to evaluate the effectiveness of the mitigation.

In addition, KAM proposed to develop and implement a Metal Leaching/Acid Rock Drainage Management Plan, which would outline procedures to prevent the generation of acid rock drainage from mine facilities and minimize the impact of metal leaching/acid rock drainage on groundwater.

KAM committed to undertaking the following additional follow-up and monitoring related to groundwater, some of which would occur under the Surface Water Management and Monitoring Plan:

- Evaluation of groundwater quality in the Peterson Creek aquifer at a location nearer to the mine site than the RES-2 residential well, and upgradient of existing monitoring wells;

- Identification and pursuit of options for monitoring private domestic wells, located outside the mine footprint, under the Surface Water Management and Monitoring Plan in order to obtain data which would inform management plans and help verify the accuracy of groundwater effects predictions;
- Development and implementation of a groundwater monitoring plan in the area between the Ajax mine boundary and Aberdeen prior to construction, in consultation with the City of Kamloops; and
- Development of a data-sharing agreement with the City of Kamloops so that available groundwater data can be used to inform relevant groundwater models and plans.

KAM also committed to developing a public complaints and resolution policy for the construction and operations phase for residents to file complaints regarding groundwater quality or quantity.

3.3 DISCUSSION OF ISSUES

During the review period, members of the working group and the public raised concerns related to the potential effects of Ajax on groundwater quality and quantity. This section provides a summary of the key issues raised and KAM's responses.

3.3.1 EFFECTS OF THE OPEN PIT ON GROUNDWATER FLOW

ECCC, MFLNR, SSN, the City of Kamloops, and members of the public were concerned that water from Jacko Lake could potentially seep into the adjacent open pit through fractures in the bedrock and faults, which could have adverse effects on water quality and quantity. These reviewers also raised concerns with the potential for complete drainage of the lake (i.e. catastrophic failure of the open pit high wall). This scenario is considered in section 20 of this Report (Accidents and Malfunctions).

Reviewers considered whether the hydraulic properties of the area between Jacko Lake and the open pit had been sufficiently investigated and whether the potential effects of Ajax on the groundwater regime, and geotechnical stability in this area, had been adequately assessed. In particular, SSN, MFLNR, the City of Kamloops, and ECCC raised concerns regarding the adequacy and number of pumping tests that KAM undertook to characterize the groundwater regime. SSN presented its interpretation of KAM's 2014 pumping test data and asserted that a potential hydraulic connection with Jacko Lake could exist. KAM acknowledged that a hydraulic connection could exist, but disagreed with SSN's analysis method and rationale, noting the difference in professional opinion, and provided rationale to further support its interpretation. SSN reiterated that Jacko Lake is a unique water body that is vulnerable to water ingress and egress from the underground aquifer and adjacent water bodies.

In response to the identified uncertainties, MFLNR, ECCC, NRCan, SSN, and the City of Kamloops recommended that additional hydrogeological investigations, including additional longer-term pumping tests, be completed to improve the understanding of the groundwater regime and to better estimate the effects of Ajax on Jacko Lake and Peterson Creek. SSN, the City of Kamloops, and ECCC recommended that these additional hydrogeological investigations be completed during the EA stage; MFLNR and NRCan noted that the investigations could be completed as part of subsequent permit application processes, should Ajax proceed.

MEMPR acknowledged that KAM had undertaken considerable work to characterize the geotechnical properties of the area between Jacko Lake and the proposed open pit, and stated that additional geotechnical investigation at the pit wall/crest and Jacko Lake would be required prior to the *Mines Act* permitting process. SSN expressed opposition to any testing or drilling within the area known as *Pípsell* because of concerns regarding potential impacts to the cultural integrity of this cultural keystone area.

KAM responded that the level of investigation completed for the EA is appropriate to predict residual effects to the groundwater regime in the project area. KAM indicated that work planned for the permitting phase would provide additional information to better understand these effects. Prior to submitting subsequent permit applications, KAM committed to undertaking additional hydrogeological investigations, including pumping tests around Jacko Lake (and the Edith Lake fault zone – see discussion below), and using the data from these pumping tests (and the 2014 pumping test) to update and recalibrate the groundwater model, as necessary.

3.3.2 EFFECTS OF THE EDITH LAKE FAULT ZONE ON GROUNDWATER FLOW AND SURFACE WATER QUALITY

NRCan, ECCC, SSN, MFLNR, and MEMPR questioned the extent to which KAM had defined the properties of the Edith Lake fault zone, including the extent, orientation, thickness, and hydraulic properties, and noted the associated uncertainty in the effects assessment. ECCC and SSN raised the concern that the fault zone could potentially become a preferential groundwater seepage pathway from the mine rock storage facilities and the tailings storage facility to Jacko Lake, and that this could affect water quality in Jacko Lake. Reviewers indicated that additional hydrogeological investigations were required to provide a more robust understanding of the potential effects of the Edith Lake fault zone on groundwater movement and water quality in the project area. SSN also advised that they have traditional knowledge relating to the connectivity of waters in Jacko Lake flowing through the fault to other water bodies, and that Ajax could potentially contaminate water quality in Jacko Lake. The City of Kamloops raised a similar concern and questioned how KAM evaluated the particle tracking from the Edith Lake fault zone to Peterson Creek.

KAM undertook additional sensitivity analyses of the hydraulic conductivity of the Edith Lake fault zone to further evaluate its potential influence on groundwater movement and water quality at Jacko Lake. The results indicated that the fault zone has negligible influence on predicted seepage to the groundwater system from Jacko Lake; however, for the higher hydraulic conductivity scenarios, groundwater discharge to Jacko Lake from the west mine rock storage facility and the tailings storage facility could be between 4 and 30 times greater than the base case, respectively. KAM predicted that the average time for seepage-affected water to reach the lake would be approximately 18 years from the west mine rock storage facility and 121 years from the tailings storage facility. KAM indicated that there would be sufficient time to implement additional mitigation measures if monitoring results showed the potential for seepage-affected water to migrate towards Jacko Lake.

NRCan noted that there are challenges associated with characterizing the hydraulic properties of faults in practice, and that estimating the potential effects of the Edith Lake fault zone on groundwater movement involves substantial uncertainty. NRCan and MFLNR indicated that a robust monitoring and adaptive management plan would be required to detect and manage potential effects to groundwater at Ajax. KAM committed to undertaking additional hydrogeological investigations in the vicinity of the Edith Lake fault zone in the permitting phase (should Ajax proceed) to improve understanding of the fault zone and its influence on groundwater movement in the project area, as well as its potential effects on surface water quality. KAM indicated that the data from these investigations would be used to update the groundwater conceptual and numerical models, as needed. The updated modelling results would then be used to inform potential new monitoring locations and adaptive management in the Surface Water and Groundwater Monitoring and

Management Plan. In addition, KAM identified potential adaptive management steps that could be implemented as part of the follow-up monitoring program. These actions may include:

- Confirmation of trigger concentration (i.e., re-sample);
- Notification of the appropriate agencies that a trigger has been exceeded;
- Completion of a risk assessment to evaluate if seepage loadings and migration rates pose a risk to the receiving environment and an assessment of the time available during which a mitigation approach may be enacted (i.e., days, months or years);
- Selection and implementation of an appropriate mitigation strategy; and
- Additional monitoring to evaluate the effectiveness of the mitigation.

3.3.3 Adequacy of Groundwater Contaminant Modelling

HC, IHA, MFLNR, SSN, and the City of Kamloops were concerned that KAM's groundwater contaminant modelling did not capture the full extent of potential effects to groundwater quality and that potentially contaminated water could occur at locations other than the RES-2 well and at potentially higher concentrations. The City of Kamloops raised the issue that using RES-2 to conduct this analysis could underestimate the effects based on the location of RES-2 in the groundwater plume. The City of Kamloops recommended that KAM monitor upgradient groundwater quality to identify the potential for any impacts to private water wells, and implement proactive mitigation measures prior to any impacts actually occurring in the downgradient wells.

KAM stated that the predicted groundwater quality at RES-2 is based on a combination of groundwater flow pathway analyses and analytical contaminant migration models, and includes many layers of conservatism. KAM identified RES-2 as the nearest hydraulically downgradient residential well that could potentially be affected by mine-impacted water, and indicated that locations downgradient of this well would be expected to have lower concentrations of contaminants of potential concern (COPC). Wells RES-5 and RES-3 are located closer to Ajax and were not included in the analysis as KAM indicated they would not be used for residential purposes. Well RES-4, located further downstream of Ajax, was not considered further since KAM's particle tracking results suggested that it does not obtain water from potential source zones (such as the east mine rock storage facility) at the project site.

The City of Kamloops raised the issue that concentrations of arsenic in Knutsford groundwater are predicted to increase as a result of Ajax. While the predicted concentration of 1.8 mg/L is below the Canadian drinking water guideline of 10 mg/L and within average naturally occurring background arsenic levels in BC, the City of Kamloops noted that the long-term effects of low-level arsenic contamination can increase the risk of developing cancer. The predicted increase in arsenic concentrations in groundwater at Knutsford would lead to an increase in the incremental lifetime cancer risk; refer to section 10 of this Report for further details.

KAM committed to evaluating groundwater quality in the Peterson Creek aquifer at a location nearer to the mine site than the RES-2 well and upgradient of existing wells prior to the start of construction. KAM also committed to developing a resolution policy to address complaints regarding groundwater quality from Knutsford groundwater users.

3.3.4 ADEQUACY OF PROPOSED GROUNDWATER MONITORING AND MANAGEMENT

MFLNR raised the concern that the groundwater monitoring locations that KAM proposed in its conceptual Surface Water and Groundwater Monitoring and Management Plan did not have sufficient density or spatial distribution to adequately predict and monitor for adverse effects. Similarly, SSN, ECCC, and the City of Kamloops questioned whether the conceptual plan would be able to detect statistically important changes in groundwater movement and quality.

In response to these concerns, KAM committed to updating the Surface Water and Groundwater Monitoring and Management Plan prior to subsequent provincial permit applications in consideration of data collected during the additional hydrogeological investigations (including at the Edith Lake fault zone and Jacko Lake). The updates to the plan would enhance the network of sampling locations, which would provide greater certainty in the ability to detect changes in groundwater movement and quality. KAM also committed to updating the groundwater models prior to permit applications and throughout the life of mine in accordance with any permit requirements, based on updated engineering design data, monitoring and performance data, and/or changes to the mine plan. The updated modelling results would, in turn, be used to inform trigger levels for adaptive management plan under the Surface Water and Groundwater Monitoring and Management Plan to detect and respond to adverse effects.

3.3.5 SLOPE STABILITY IN ABERDEEN

Members of the public raised concerns regarding the potential changes to groundwater levels and slope stability as a result of Ajax. The Aberdeen Neighbourhood Association was concerned that blasting could potentially re-activate historic landslides in the Aberdeen Hills area. ECCC noted that blasting could potentially result in greater groundwater flows because of weak rock formations in the Ajax area.

Based on the results of the groundwater flow modelling, KAM predicted that there would be no net increase in groundwater elevations in the Aberdeen area resulting from Ajax. KAM acknowledged that the slope stability issue in Aberdeen may be sensitive to relatively minor increases in groundwater levels, but maintained that the Ajax groundwater model predictions are robust. KAM also assessed the effects of blasting on slope stability in Aberdeen and determined that slope stability impacts in the Aberdeen neighbourhood would be below the range of detection. KAM committed to monitor vibration levels and to convening a Community Liaison Group that would have an opportunity to review monitoring results, including slope stability information. KAM also indicated that the monitoring locations in the slope stability and pore water pressure monitoring plan and the Surface Water and Groundwater Monitoring and management plan would be determined in consideration of the results of the blasting effects assessment.

In response to the identified concerns, KAM committed to developing and implementing, in consultation with the City of Kamloops, a slope stability and pore water pressure monitoring plan for the area between Ajax and Aberdeen prior to the start of construction.

For further information regarding the potential effects of blasting on slope stability, refer to section 9 of this report.

3.3.6 GROUNDWATER WELL PRODUCTIVITY

MFLNR and the City of Kamloops noted that there are existing groundwater wells and licence holders in the vicinity of Ajax who have rights under the *Water Sustainability Act* that could be impacted by changes in groundwater quantity resulting from Ajax. MFLNR and the City of Kamloops requested that KAM provide additional information regarding the potential losses that these groundwater users could experience as a result of Ajax, and how the effects would be mitigated or compensated.

KAM predicted that changes in groundwater elevations would extend up to 2 km from project facilities, which includes one private/domestic well and three commercial/industrial wells. KAM indicated that, should Ajax cause a decrease in productivity of groundwater wells, KAM would relocate or deepen the well to meet the water supply demand. This would require investigation of the existing well conditions and consent from residents.

3.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

3.4.1 GROUNDWATER QUALITY

In consideration of KAM's proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in the following residual effects to groundwater quality:

- Increases in the concentrations of fluoride, sulphate, copper, iron, manganese, molybdenum, and zinc in groundwater in the vicinity of Ajax.

The Agency and EAO are of the view that groundwater quality in proximity to Ajax would be degraded as a result of uncaptured seepage (contact water) migrating from mine facilities to local groundwater. The seepage pathways and modelled groundwater discharges indicate that groundwater would affect surface water quality in Peterson Creek and Humphrey Creek. Refer to section 2 for the surface water quality assessment and conclusions, which considered inputs from groundwater.

The Agency and EAO considered the RES-2 residential well as a proxy to evaluate potential impacts to downgradient groundwater users within 2 km of project facilities, and note that any impacts to groundwater uses further downgradient of this location would be expected to be smaller. Groundwater uses near Ajax include domestic purposes, irrigation, and livestock watering. The Agency and EAO find that the predicted concentrations of the above listed parameters at RES-2 would exceed relevant guidelines, but are within the range of natural variation. The Agency and EAO note that the baseline concentrations of most parameters also exceeded the relevant guidelines.

The largest predicted changes in concentrations are for manganese and molybdenum; concentrations of these parameters are predicted to increase by 39% and 47%, respectively, from baseline conditions. The maximum predicted concentration of manganese would slightly exceed the aesthetic drinking water objectives. For molybdenum, the maximum predicted concentration would slightly exceed the BC water quality guidelines for irrigation, which could affect the health of vegetation irrigated with this water. Concentrations of fluoride, sulphate, copper, iron, and zinc, should the groundwater discharge to surface water bodies, are predicted to exceed aquatic life guidelines, but these parameters also exceeded the guidelines under baseline conditions.

While there were no predicted exceedances of the health-based drinking water guidelines at RES-2, exceedances of the aesthetic drinking water quality objectives were predicted for sulphate, iron, and manganese, which could affect the smell and taste of the groundwater. Sulphate and iron also exceeded the aesthetic objective under baseline conditions. Additionally, predicted and baseline concentrations of sulphate exceeded livestock watering guidelines, which could affect the health of livestock if this groundwater were provided for livestock watering purposes.

The Agency and EAO note that Ajax is predicted to cause an increase in the concentration of arsenic in groundwater in Knutsford. While the predicted concentration (1.8 mg/L) is below the Canadian drinking water guideline (10 mg/L) and within average naturally occurring background arsenic levels in BC, the Agency and EAO note that the increase in concentration of this parameter in drinking water can increase the risk of developing cancer; refer to section 10 for the assessment of effects to human health.

The Agency and EAO are of the view that the modelling KAM undertook was sufficiently robust to capture the range of potential residual effects to groundwater quality. However, the Agency and EAO acknowledge that there are uncertainties related to the modelled predictions and the approach to using the RES-2 well as a proxy for assessing the potential effects to groundwater quality, especially at locations closer to the proposed mine. To address these uncertainties, the EAO is proposing an EA Certificate condition that would require KAM to conduct an evaluation of groundwater quality in the Peterson Creek aquifer at a location nearer to the mine site than the RES-2 monitoring well and upgradient of existing wells prior to construction, and to incorporate the results in groundwater management and monitoring planning. The EAO is also proposing an EA Certificate condition that would require KAM to develop a process for receiving and addressing public complaints and inquiries.

The Agency and EAO note that there are regulatory requirements under BC's *Environmental Management Act, Water Sustainability Act,* and *Mines Act* for groundwater quality management, monitoring and reporting that would form part of the permitting processes following the EA, should Ajax proceed. The EAO would work closely with other provincial regulatory authorities on any complementary monitoring and management requirements, and the compliance and enforcement of those requirements.

The Agency and EAO consider that the changes in concentrations of some parameters in groundwater would exceed relevant guidelines, but would be within the range of natural variation. The effects would occur within the local study area, and would persist into the post-closure phase of Ajax. The effects would be irreversible, but would decrease in magnitude with time, since reclamation of mine facilities would reduce the source loading which would partially reverse the effects.

The Agency and EAO's characterization of the potential residual effects of Ajax on groundwater quality, as well as the level of confidence in the effects determination of the potential residual effects, are summarized in Appendix A.

3.4.1.1 *Cumulative Effects*

The Agency and EAO are of the view that past and present projects and activities, including seepage from ranching activities, residential properties, roads and highways, and the sand and gravel quarry located adjacent to Peterson Creek, could contribute to cumulative effects to groundwater quality in the regional study area. Contributions from these past and present sources were captured by KAM in its description of baseline conditions, and have been accounted for in the water quality modelling. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual adverse effects discussed above. The Agency and EAO accept KAM's findings that the New Afton Project and the historical Afton tailings storage facility would not result in cumulative groundwater quality effects, since the seepage flow pathways in the groundwater modelling indicate that contaminants would not migrate between Ajax and these projects.

The Agency and EAO are of the view that increased runoff and seepage from future growth and expansion of the City of Kamloops, as well as changes to existing projects and activities in the regional study area, could potentially contribute to cumulative effects to groundwater quality. However, the Agency and EAO note that there would be limited spatial overlap with the residual effects to groundwater quality from Ajax, since the groundwater seepage pathways associated with Ajax are predicted to surface within the local study area only, and would not extend into the regional study area. The migration of contaminants through groundwater seepage pathways into surface water are captured in the surface water quality modelling and are thus accounted for in the assessment of cumulative effects to surface water quality (section 2).

3.4.1.2 *Conclusion*

The Agency and EAO evaluated changes to groundwater quality as a pathway valued component. Changes in groundwater quality have the potential to affect ecological values and humans, which are the ultimate receptors. As such, the results of the groundwater quality assessment inform the assessment and significance determinations for the following receptor valued component assessments: Surface Water (section 2), Human Health (section 10), and Land and Resource Use (section 15).

3.4.2 GROUNDWATER QUANTITY

In consideration of KAM's proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in the following residual effects to groundwater quantity:

- Changes in the local groundwater balance within 2 km of project facilities, including:
    - Decreases in groundwater elevations by approximately 100 m near the pit, and increased groundwater elevations by approximately 100 m under the tailings storage facility in post-closure; and
    - Changes in groundwater recharge and discharge.

The Agency and EAO are of the view that development of Ajax is likely to decrease groundwater quantity within approximately 2 km from mine facilities. The effect would be greatest near the open pit and tailings storage facility, and would decrease with distance from these areas. By approximately 2 km from these facilities, the change in groundwater elevation is predicted to be less than 1 m. To address uncertainties related to the effects on private groundwater wells within the affected area, the EAO is proposing an EA Certificate condition that would require KAM to develop a plan that would describe how KAM would ensure the water supply of these groundwater users is maintained.

The Agency and EAO are of the view that the groundwater levels in the Aberdeen area to the north of Ajax would not be affected, given the results of the sensitivity scenarios and the interpreted groundwater divide to the north of Ajax. However, the Agency and EAO acknowledge that slope stability in the Aberdeen area may be sensitive to relatively small changes in groundwater levels. KAM committed to developing a slope stability and pore water pressure monitoring plan for the area between Ajax and Aberdeen prior to the start of construction, in consultation with the City of Kamloops, and to initiate a data-sharing agreement with the City of Kamloops to ensure that available groundwater data can be used to inform relevant groundwater models and plans. As a measure of transparency and accountability, the EAO is proposing an EA Certificate condition that would require KAM to fulfil these commitments.

The Agency and EAO note that there are uncertainties with respect to KAM's characterization of the existing conditions and predicted effects to groundwater, including the potential for the Edith Lake fault zone to act as a conduit for groundwater flow to Jacko Lake, and for Jacko Lake to seep into the open pit. The Agency and EAO are of the view that the level of investigation and modelling undertaken by KAM is appropriate for the purposes of the EA and conservatively brackets the range of potential effects to groundwater quantity and quality. KAM's commitment to complete additional hydrogeologic investigations in the permitting phase, including additional pumping tests around the Edith Lake fault zone and Jacko Lake, and related updates to the groundwater models and Surface Water and Groundwater Monitoring and Management Plan, is acceptable to the Agency and EAO.

The Agency and EAO are of the view that the residual effects to groundwater quality and quantity, including seepage from Jacko Lake to the open pit and the influence of the Edith Lake fault zone on groundwater movement, can be managed through robust monitoring and adaptive management. The Agency and EAO note that there are adaptive management measures such as installation of interception wells, cut-off walls, horizontal drains, and grouting, that KAM could apply at Ajax if monitoring results indicated the potential for uncontrolled seepage from Jacko Lake to the open pit, or for seepage-affected water to migrate towards Jacko Lake. The EAO is proposing EA Certificate conditions that would require KAM to conduct additional groundwater investigations, and then to prepare a groundwater management and monitoring plan that would incorporate the results of the additional investigations, including additional pumping tests, as well as updated groundwater modelling results.

The Agency and EAO consider that the adverse residual environmental effects of Ajax on groundwater quantity would be substantially altered from baseline conditions near the open pit and tailings storage facility, and would decrease to within the range of natural variability by approximately 2 km of project facilities. Although the effects would persist in the post-closure phase, and would be continuous and irreversible, they would be limited to approximately 2 km from Ajax facilities where there are four registered groundwater wells that would potentially require deepening or relocating. No effects on groundwater elevations are predicted for the Aberdeen area.

The Agency and EAO's characterization of the residual effects of Ajax on groundwater quantity, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

3.4.2.1 *Cumulative Effects*

The Agency and EAO are of the view that groundwater use for agriculture, ranching, and domestic purposes in the regional study area could potentially interact with the predicted changes to the groundwater balance caused by Ajax and result in a cumulative effect to groundwater quantity. Growth of the City of Kamloops towards the mine site could also add to the predicted residual effects to groundwater quantity. The Agency and EAO are of the opinion that the cumulative effect would be low magnitude since the residual effect to groundwater quantity extends up to 2 km of project facilities and would have limited geographic overlap with these activities within the regional study area.

3.4.2.2 *Conclusion*

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to groundwater quantity.

Taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to groundwater quantity.

4 Fish and Fish Habitat

4.1 BACKGROUND

This section provides a summary of potential effects of Ajax on fish and fish habitat as identified by KAM, the mitigation measures proposed by KAM to address those effects, and a discussion of the key fish and fish habitat issues raised during the EA. It also sets out the analysis and conclusions of the Agency and EAO regarding Ajax's potential adverse effects to fish and fish habitat.

The assessment of potential effects to fish and fish habitat considers inputs from the assessment of effects to Surface Water Quality and Quantity presented in the Report (section 2). Changes in fish and fish habitat have the potential to impact ecological values and humans, therefore the results of this assessment were also used to inform the following assessments: Human Health (section 10), Recreation (section 12), Land and Resource Use (section 15), Current Use of Lands and Resources for Traditional Purposes (section 18), and impacts to Aboriginal Interests (Part C).

The *Fisheries Act*, administered by DFO, prohibits any work, undertaking or activity that results in serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery unless authorized. Serious harm to fish is defined in the *Fisheries Act* as "the death of fish or any permanent alteration to, or destruction of, fish habitat." DFO's Fisheries Protection Policy Statement (DFO 2013) states that offsetting is required when residual serious harm to fish remains after avoidance and implementation of mitigation measures. An offset measure is one that counterbalances unavoidable serious harm to fish resulting from a project with the goal of maintaining or improving the productivity of the commercial, recreational or Aboriginal fishery. It also states that offset measures should support fisheries management objectives and local restoration priorities. [16]

4.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

4.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

Ajax is located within the Peterson Creek watershed, adjacent to Jacko Lake. The Peterson Creek watershed includes Keynes Creek, Humphrey Creek, Goose Lake, and Edith Lake. Peterson Creek and Jacko Lake provide habitat for Rainbow trout in the project footprint. Goose Lake, Keynes Creek and Humphrey Creek, within the Ajax footprint, are non-fish bearing.

The local study area includes the mine site and infrastructure and surrounding area within which there is a reasonable potential for the Ajax to have immediate direct and indirect effects on fish, fish habitat and aquatic resources. The major water bodies within the local study area are Jacko Lake, Peterson Creek, Cherry Creek, and

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[16] DFO 2013, Fisheries Protection Policy Statement http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index-eng.html

Goose Lake. The regional study area, within which there is potential for direct, indirect and cumulative effects, comprises the Peterson Creek watershed to the confluence with the South Thompson River, as well as a buffer (approximately 0.5 km wide) along the proposed water supply pipeline from Kamloops Lake to the mine site.

Jacko Lake covers an area of 47.8 hectares, and provides rearing and overwintering habitat for Rainbow trout stocked annually in the lake. Water levels and surface area of Jacko Lake have been increased by construction of a water storage dam at the lake outlet in 1925, and increases to the dam height in the 1970s and 1990.

Jacko Lake is stocked with Rainbow trout and supports a recreational and Indigenous fishery. Provincial fishery records indicate that no fish were present in Jacko Lake in 1939 and that the lake has been stocked annually with Rainbow trout since 1954. SSN reported that Rainbow trout were present in Jacko Lake prior to the lake being stocked and that Secwepemc people utilized traditional fishing methods at the inflow and outflow of the lake for a naturally reproducing food fishery. SSN has a spring trout fishery at the outlet of Jacko Lake, which flows into Peterson Creek, within the local study area.

Peterson Creek is a 35 km long tributary of the South Thompson River, with headwaters to the southwest of the city of Kamloops. Upper Peterson Creek flows into Jacko Lake, and then flows out of Jacko Lake toward Kamloops. Peterson Creek has been heavily impacted by irrigation and ranching activities. The water storage dam and control gate that regulates flows at the outlet of Jacko Lake prevents adult Rainbow trout from moving downstream of Jacko Lake into Peterson Creek, except during the higher water levels of spring freshet when fish can enter the spillway. The dam at the outlet of Jacko Lake and Bridal Veils Falls in lower Peterson Creek are barriers to upstream fish migration.

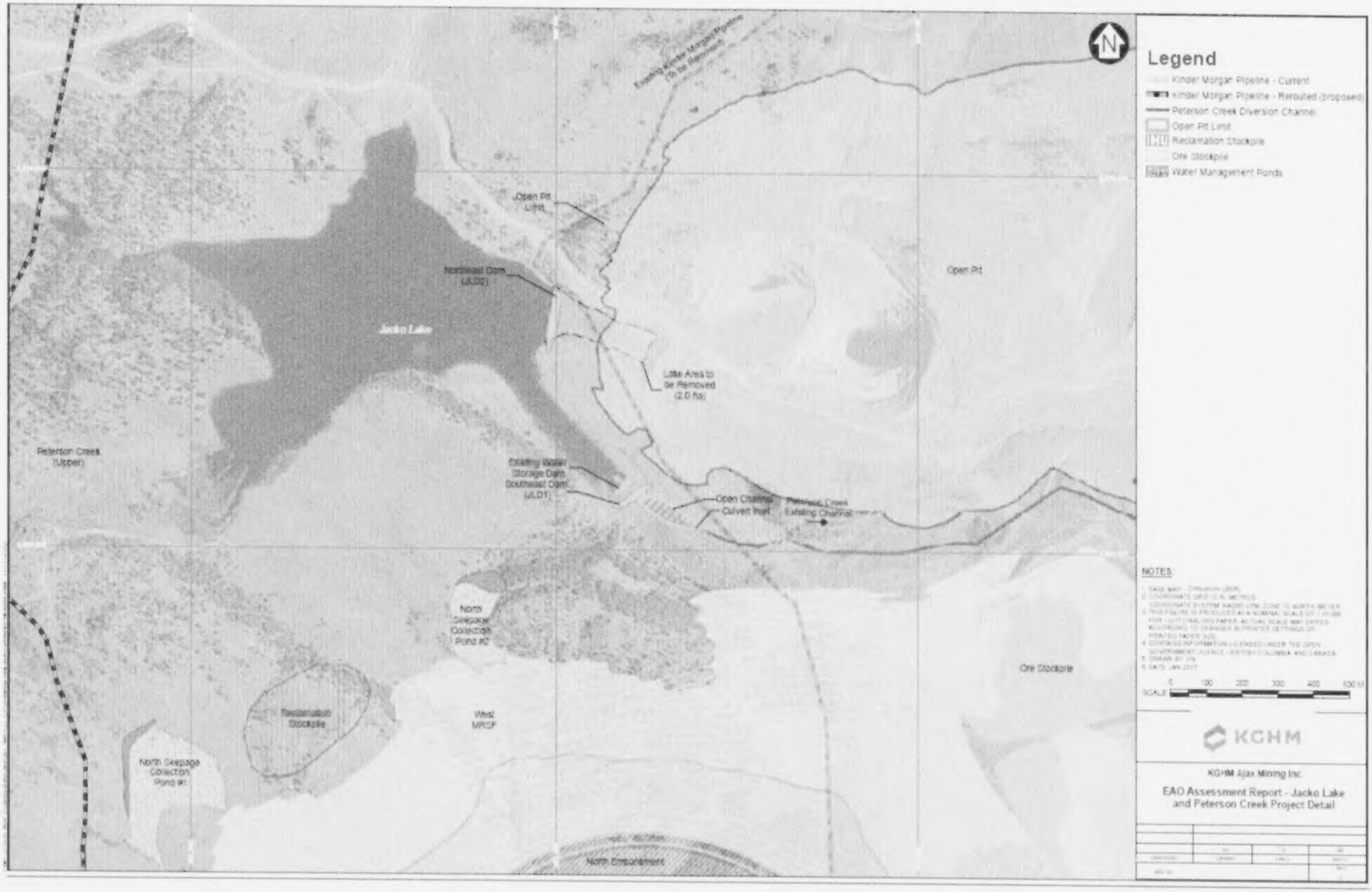
KAM stated that Peterson Creek within the Ajax area downstream of Jacko Lake offers marginal Rainbow trout spawning and rearing habitat due to the high silt content of the substrate, lack of instream cover, low channel complexity, minimal riparian habitat, and high summer water temperatures and low dissolved oxygen concentration due to low flows. Rainbow trout in Peterson Creek in the Ajax area therefore do not support a recreational fishery or contribute to the productivity of the Jacko Lake Rainbow trout population.

The lower 150 m section of Peterson Creek at the confluence with the South Thompson River also provides rearing habitat for juvenile Coho and Chinook salmon, and contains Rainbow and Bull trout.

The South and North Thompson Rivers converge and widen to become Kamloops Lake, which is located north of Ajax. Kamloops Lake provides productive habitat and supports a number of fish species, including salmon (Chinook, Coho, Pink and Sockeye), Rainbow trout, provincially blue-listed Bull trout, provincially yellow-listed Dolly Varden char, and *Species at Risk Act*-listed and provincially red listed White sturgeon. KAM would upgrade an existing water intake in Kamloops Lake to supply process water for Ajax. The shoreline of Kamloops Lake in the vicinity of the intake is a steep and rocky (rip-rap, boulders and cobbles) bank that is sparsely vegetated with sagebrush. KAM reported that the water intake area provides poor quality spawning habitat for most fish species in Kamloops Lake.

Figure 5 provides an overview of project facilities around Jacko Lake and Peterson Creek.

Figure 5: Overview of Project Facilities around Jacko Lake and Peterson Creek


Legend
Kinder Morgan Pipeline - Current
Kinder Morgan Pipeline - Rerouted (proposed)
Peterson Creek Diversion Channel
Open Pit Limit
Reclamation Stockpile
Ore Stockpile
Water Management Ponds
N
Existing Kinder Morgan Pipeline (To be Removed)
Open Pit Limit
Northeast Dam (JLD2)
Jacko Lake
Open Pit
Lake Area to be Removed (2.0 ha)
Peterson Creek (Upper)
Existing Water Storage Dam Southeast Dam (JLD1)
Open Channel Culvert Inlet
Peterson Creek Existing Channel
NOTES:
North Seepage Collection Pond #2
Ore Stockpile
Reclamation Stockpile
West MRSF
North Seepage Collection Pond #1
North Embankment
0
100
200
300
400
500 M
SCALE
KGHM
KGHM Ajax Mining Inc.
EAO Assessment Report - Jacko Lake and Peterson Creek Project Detail

Source: KAM response to EAO request, March 2017

4.2.2 KAM EFFECTS AND MITIGATION MEASURES

The following section summarizes KAM's assessment of the potential effects of Ajax on fish and fish habitat and its proposed mitigation measures to avoid, reduce or offset those effects.

4.2.2.1 *Habitat Loss*

KAM predicted that Ajax would result in serious harm to fish and fish habitat because of the permanent loss of habitat resulting from the construction of the dams on the northeast and southeast arms of Jacko Lake. Additionally, KAM would divert a portion of Peterson Creek through a 2.7 km long culvert situated 150 m downstream of the outlet of Jacko Lake to avoid the open pit. A total of 10.38 hectares of fish habitat would be lost from Jacko Lake and Peterson Creek; the types and amount of habitat predicted to be lost are shown in Table 9.

Table 9: Fish Habitat Loss due to project Construction

Project components	Fish Habitat Loss (hectares)			
	Stream	Lake	Riparian	Total
Jacko Lake dams	-	1.87	0.79	2.66
Peterson Creek diversion	3.35	-	4.37	7.72
Total	**3.35**	**1.87**	**5.16**	**10.38**

The lake area to be removed within the northeast arm of Jacko Lake, and the Peterson Creek diversion around the open pit, are shown on Figure 5 above. Installation of a sheet pile dam for the northeast dam (shown as JLD2 in Figure 5) would be required to dewater the northeast arm of Jacko Lake, and allow for removal of the existing Kinder Morgan Canada pipeline crossing under the northeast arm, prior to development of the open pit.

KAM noted that the permanent loss of fish habitat within the northeast arm of Jacko Lake (2.08 hectares lake habitat) represents approximately 4% of the total lake area, and 9% of the total littoral habitat area (i.e. lake area with less than 3 m depth). KAM concluded the lost area within the northeast arm contributes at least 5% to 10% of the total fish food production in Jacko Lake. The southeast dam (shown as JLD1 in Figure 5) to be constructed in the southeast arm downstream of the existing lake outlet would increase the lake area by 0.21 hectares, thereby reducing the total lake habitat loss to 1.87 hectares.

The section of Peterson Creek to be diverted around the open pit was characterized by KAM as being marginal fish habitat because of the high silt content of the substrate, lack of instream cover, low channel complexity, minimal riparian habitat, and summer high water temperatures and low dissolved oxygen due to low flows. The Peterson Creek diversion system would maintain an open channel in a 150 m section downstream of Jacko Lake in order to reduce habitat loss and to mitigate effects to SSN's Indigenous spring trout fishery. KAM concluded that none of the habitat losses are predicted to decrease the overall number of Rainbow trout in Jacko Lake and Peterson Creek.

KAM stated that upgrading the existing water intake on Kamloops Lake to install a new intake pipe would result in a temporary alteration of approximately 300 m^2 of fish habitat. The new intake pipe would be installed by excavating along the foreshore and dredging a trench below the water level to ensure the pipe is buried to a sufficient depth to prevent freezing. The trench would be backfilled prior to restoration of the foreshore area. KAM noted the temporary alteration of habitat would be limited to the construction period. KAM concluded that these upgrades to the water intake on Kamloops Lake, and water withdrawal for Ajax water supply, would have a negligible effect on fish and fish habitat in Kamloops Lake (see discussion of Kamloops Lake Intake below).

Construction of the tailings storage facility and mine rock storage facilities would result in the removal of non-fish bearing waters, including: Goose Lake, portions of Keynes Creek and tributaries to Keynes Creek. KAM stated that Goose Lake, Keynes Creek and Humphrey Creek would not be considered fish habitat under the *Fisheries Act* due to the lack of fish presence and the lack of connectivity to fish-bearing waters. As a result, they were not considered in this section.

KAM would require a *Fisheries Act* authorization and offsetting plan for unavoidable serious harm to fish associated with the permanent destruction of fish habitat in the northeast arm of Jacko Lake, and the diversion of a portion of Peterson Creek around the open pit. KAM's revised Conceptual Fish Habitat and Fishery Offsetting Plan submitted during the EA included the following offset measures:

- Expansion of the west arm of Jacko Lake resulting in a potential net gain of 2.66 hectares of lake surface area and 79,000 m^3 of volume;
- Restoration and enhancement of Upper Peterson Creek at the inlet to Jacko Lake;
- Maintenance and enhancement of Peterson Creek at the outlet of Jacko Lake to maintain SSN's Indigenous fishery; and
- Restoration of lower Peterson Creek for approximately 150 m upstream of the confluence with the South Thompson River to improve juvenile salmon habitat for Chinook and Coho including the Interior Fraser Coho population, which is listed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and makes up an Evolutionarily Significant Unit.

4.2.2.2 *Direct Mortality*

KAM predicted that Ajax could result in direct mortality of fish due to:

- Increased fishing in Jacko Lake due to Ajax workforce;
- Construction of instream works (e.g. sheet pile dam in Jacko Lake, diversion of Peterson Creek, upgrades to the water intake on Kamloops Lake);
- Blasting in the open pit once a day during operation; and
- Entrainment or impingement on the water intake screens in Peterson Creek (diversion culvert) and Kamloops Lake (process water intake).

KAM's proposed mitigation measures to avoid or reduce direct mortality to fish include:

- Restricting angling and access to the lake from the mine property for project employees to minimize direct mortality resulting from increased fishing;
- Establishing blast designs and procedures taking into consideration DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat[17], and Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters[18];
- Installing a sheet pile dam across the northeast arm of Jacko Lake that would exclude fish from the eastern shore and further mitigate mortality resulting from blasting near the edge of the open pit;
- Keeping underwater pressure and sound levels below the threshold for physical injury to fish, in accordance with National Oceanic and Atmospheric Administration's interim criteria for the onset of physical injury to fish, during installation of the sheet pile dam across the northeast arm of Jacko Lake; and
- Installing screens on water intakes taking into consideration DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat, and Freshwater Intake End-of-Pipe Fish Screen Guideline[19], to avoid entrainment and impingement of fish.

4.2.2.3 *Water Quality*

KAM assessed sub-lethal effects to fish from changes in water quality due to soil erosion, seepage from the tailings storage facility and mine rock storage facilities, and dustfall deposition in watercourses.

KAM compared current baseline water quality conditions and predicted future surface water quality against BC and Canadian Council of Ministers of the Environment water quality guidelines for the protection of aquatic life. KAM noted that potential effects to water quality with respect to aquatic life requirements were not carried forward in the fish and fish habitat assessment in order to reduce duplication with the surface water quality assessment. See section 2 of the Report for assessment of potential effects to surface water quality.

KAM noted that the results of the predictive water quality modelling were also used in the Human Health and Ecological Risk Assessment to estimate potential effects to fish and benthic invertebrate communities associated with changes in sediment quality. Potential health effects to benthic invertebrates were assessed in comparison to BC and Canadian Council of Ministers of the Environment sediment quality guidelines for the protection of aquatic life. KAM concluded there would be no residual effects to fish and benthic invertebrate communities in Jacko Lake and Peterson Creek associated with changes in sediment quality.

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[17] DFO 2013, Measures to Avoid Harm to Fish and Fish Habitat http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html

[18] Wright and Hopky 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. http://www.dfo-mpo.gc.ca/Library/232046.pdf

[19] DFO 1995, Freshwater Intake End of Pipe Fish Screen Guideline. http://www.dfo-mpo.gc.ca/Library/223669.pdf

To avoid and minimize effects to water quality that could impact fish habitat, KAM's proposed mitigation measures include implementation of the Surface Water Quality Management and Monitoring Plan, including:

- Interception ditches to collect contact water. These ditches will prevent seepage from the tailings storage facility and waste rock management facilities from entering Jacko Lake and Peterson Creek;
- Placement of a dry cover on the tailings storage facility at closure and decommissioning to reduce infiltration; and
- Placement of a low permeability till layer overlain with topsoil on waste rock storage facilities to reduce excess water infiltration.

KAM also committed to reduce erosion and sediment effects to fish and fish habitat via implementation of the Erosion and Sediment Control Plan, which includes measures such as:

- Timing potentially erosion or sediment generating operations to avoid wet weather, when working in environmentally sensitive areas, to minimize storm water runoff and erosion risk; and
- Avoiding handling soil during prolonged periods of dry and windy weather to minimize wind erosion and generation of dust.

KAM assessed the potential for water quality effects on fish, and determined that there would not be residual effects to fish and fish habitat since predicted water quality concentrations in Jacko Lake would not exceed applicable guidelines or current background concentrations. For a more detailed discussion of potential effects of Ajax on surface water quality, and associated mitigation measures, see section 2 of the Report.

4.2.2.4 *Water Quantity*

KAM predicted that reduced streamflows in Peterson Creek (upper and lower) would occur during all project phases as a result of a reduced watershed size, capture of contact water and potential seepage from Jacko Lake to the open pit. The average mean annual flow in Peterson Creek is estimated to be reduced by 12% during construction, 17% during operations, and 6% during the post-closure phase.

KAM stated that effects on surface water temperature and dissolved oxygen concentration associated with reduced flows in Peterson Creek downstream of the mine site are anticipated, however the magnitude of flows during September to April are currently very small and the Rainbow trout population in Peterson Creek upstream of Bridal Veil Falls is maintained with the existing thermal regime.

Flow reductions present the greatest risk to fish and fish habitat from October to April during operations. KAM has committed to fully offset these flow reductions in Peterson Creek by augmenting with water from Kamloops Lake. KAM reports that it is working with the MFLRN on suitable mitigation measures to avoid any change to instream flow in order to protect fish and fish habitat.

KAM predicted the water withdrawal from Kamloops Lake required for the Ajax water supply during operations would reduce average monthly flows through Kamloops Lake by 0.25%. KAM stated that this reduction in flow would not affect fish and fish habitat in Kamloops Lake and the Thompson River.

For a more detailed discussion of potential effects of Ajax on surface water quantity, and associated mitigation measures, see section 2 of the Report.

4.2.3 KAM'S CONCLUSIONS ON RESIDUAL EFFECTS

KAM concluded that, after implementation of mitigation measures, Ajax would result in residual effects to fish and fish habitat. These residual effects include direct and indirect habitat loss in Jacko Lake and Peterson Creek, and direct mortality due to installation of the sheet pile dam in Jacko Lake.

4.2.4 CUMULATIVE EFFECTS

KAM's cumulative effects assessment noted that current and past agriculture, ranching and mining activities have contributed to effects to fish habitat in lakes and streams within the local and regional study area, and were considered as part of the baseline conditions for fish and fish habitat.

The proposed future Trans Mountain Expansion Project (TMX) pipeline corridor would be located west of Jacko Lake. Mitigation measures (e.g., erosion and sediment control) would be implemented during pipeline construction such that there would be no residual effects to watercourses that flow into Jacko Lake, therefore, it was not carried forward in KAM's assessment of cumulative effects to fish and fish habitat.

KAM stated there would be no residual effects of Ajax to fish and fish habitat in Kamloops Lake as a result of upgrades to the existing water intake and water withdrawal for water supply, therefore this was not included in the cumulative effects assessment.

KAM stated that ranching and agriculture have the potential to contribute to cumulative effects to fish and fish habitat due to interactions with Ajax's residual effects on Peterson Creek. Livestock grazing could cause effects to instream and riparian habitat (e.g., reduction of riparian vegetation and stream cover due to grazing; addition of sediment through bank degradation and soil erosion), and effects to water quality (e.g., increased turbidity, decreased dissolved oxygen, increased temperature). KAM noted that ranching and agriculture activities are limited to the south and west shores of Jacko Lake, which would not be impacted by Ajax. KAM concluded that the potential for ranching and agriculture to interact with project related residual effects on Peterson Creek would be negligible to minor; therefore, the cumulative environmental effects to fish and fish habitat are anticipated to be minor and not significant.

4.2.5 MONITORING AND FOLLOW-UP

KAM proposed to include the following components in a monitoring and follow-up program for Ajax:

- Implementation of a Fisheries and Aquatic Life Monitoring Plan and Surface Water Quality Management and Monitoring Plan, including:

- Sampling fish, sediment quality, primary producers (periphyton, phytoplankton), and benthic invertebrates in Jacko Lake and Peterson Creek, at the same monitoring locations established for the Surface Water Quality Monitoring Plan;
- An Aquatic Effect Monitoring Program utilizing a before-after-control-impact comparison of environmental indicators (i.e., water quality, fish population, benthic invertebrate community, and fish tissue), consistent with the Metal Mining Technical Guidance for Environmental Effects Monitoring20 (Environment Canada 2012);
- Assessing predicted flow changes against actual flow changes in Peterson Creek. Flow and hydraulic characteristics at the established transect sites will be monitored during all phases to assess whether the predicted flow changes meet the recommended flow threshold for BC streams. Should monthly values be measurably different than predicted values, additional mitigation measures will be considered, which could include working with the provincial government to manage releases from Jacko Lake to meet instream flow needs to protect fish and fish habitat;
- Assessing the effects of blasting on fish. This would include measuring pressure levels in the water column during blasting and visual observations following blasting to assess for potential fish mortality; and
- Monitoring of underwater sound pressure level and sound exposure levels during installation of the sheet pile dam to avoid fish injury and mortality.

The Fish Habitat and Fishery Offsetting Plan would be constructed over a two year period following project approval to accommodate least risk timing windows for instream works while avoiding disturbance to the public. Starting one year after construction,, KAM has committed to commence a five year monitoring program to demonstrate the success of the constructed offsetting measures to confirm that the measures are effective, and to determine whether further measures are required for compliance with the *Fisheries Act* authorization.

4.3 DISCUSSION OF ISSUES

During the EA, members of the working group, Indigenous groups, and the public raised concerns related to the potential effects of Ajax on fish and fish habitat. This section provides a summary of the key issues raised and KAM's responses.

4.3.1 EFFECTS FROM BLASTING

DFO, MFLNR, the City of Kamloops, and SSN expressed concerns that blasting in the open pit could disturb fish and cause fish mortality in Peterson Creek, and along the eastern shore of Jacko Lake. SSN was concerned that

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[20] Environment Canada, 2012. Metal Mining Technical Guidance for Environmental Effects Monitoring

lower trout numbers because of blasting mortality could affect functioning of the Jacko Lake ecosystem, including animals that depend on fish.

KAM stated that the blast designs and procedures would follow DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat for blasting in the open pit. The EAO has proposed an EA Certificate condition that would require KAM to develop and implement a Fisheries and Aquatic Life Management and Monitoring Plan that includes measures to avoid or mitigate potential mortality and injury to fish associated with blasting in the open pit during project operations.

KAM noted that with implementation of DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat and blasting designs developed to minimize impacts on fish in Jacko Lake, underwater pressure is predicted to be a maximum of 17 kPa in Jacko Lake, well below the threshold of 100 kPa for fish mortality.

KAM stated blasting would occur on average once per day during project operations. In response to comments from MFLNR noting the majority of anglers are on the lake fishing between 10:00 a.m. and 2:00 p.m., KAM committed to scheduling blasting outside of this period (effective April 1 to October 31 and only when the blast clearance radius extends into Jacko Lake). KAM provided a seasonal blasting schedule and additional mitigation and monitoring for blasting in its Fisheries and Aquatic Life Monitoring Plan. For additional discussion of potential effects of Ajax on recreational fisheries, see section 12 of the Report.

4.3.2 EFFECTS FROM SHEET PILE DAM INSTALLATION ON FISH MORTALITY IN JACKO LAKE

MFLNR, the City of Kamloops, and the public raised concerns regarding mitigation and monitoring of effects to fish mortality from underwater sound exposure and pressure during sheet pile installation for construction of the dam in Jacko Lake.

KAM noted that installation procedures would be designed to meet or be lower than the National Oceanic and Atmospheric Administration's interim criteria for the onset of physical injury to fish. A monitoring program would be implemented during pile driving taking into consideration the Best Management Practices for Pile Driving and Related Operations Policy developed by the British Columbia Marine and Pile Driving Contractors Association and DFO (2003) and the Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish (ICF Jones & Stokes and Illingworth and Rodkin, Inc. 2012). This program would include visual and hydrophone monitoring of the impact of sound waves on fish.

If fish mortality occurred, or if sound pressure levels or sound exposure levels criteria were exceeded, KAM committed to cease work and apply additional mitigation measures to either reduce the level of the shockwave or to prevent fish from entering the potentially harmful impact zone.

4.3.3 CONCEPTUAL FISH HABITAT AND FISHERY OFFSETTING PLAN

DFO, along with the public and SSN, questioned the feasibility and adequacy of KAM's original plan to offset fish habitat losses in Jacko Lake and Peterson Creek with newly created habitat in Inks Lake, a non-fish bearing waterbody located west of Jacko Lake. In addition to the concerns of DFO and the public regarding the feasibility of the Inks Lake offsetting, SSN noted that habitat created in Inks Lake would not offset the loss of SSN's spring trout fishery. In response, KAM revised the Conceptual Fish Habitat and Fishery Offsetting Plan, which proposed to offset habitat in Jacko Lake and Peterson Creek.

DFO, MFLNR, and SSN raised concerns with the proposed habitat offsetting ratios in the revised Conceptual Fish Habitat Offsetting Plan. MFLNR stated that offsetting measures need to replace impacted areas at an offsetting ratio higher than the loss due to risk of failure, time lag, and potential for Ajax to adversely affect the offsetting works in the future. DFO stated that it would need to be assured, at a conceptual level, that there would be no net loss of habitat and that offsetting would be sufficient to balance any loss in habitat. KAM clarified the methodology it applied to quantify lost and offset habitat, based on habitat units, which considers the quality and quantity of habitat type. DFO stated that the Conceptual Fish Habitat and Fishery Offsetting Plan was adequate for the EA, and that further discussions between KAM and DFO regarding the development and application of offsetting ratios would be required if Ajax proceeds to permitting.

MFLNR raised concerns with the offset proposal to construct spawning habitat at the inlet and outlet of Jacko Lake and potential impacts on the recreational fishery stocking program due to recruitment of Rainbow trout into Jacko Lake from upper Peterson Creek. KAM noted that fish access and habitat quality in upper Peterson Creek is primarily limited by low flows, and the creek channel typically goes dry in the summer months; therefore, even if spawning is successful it would not likely result in any increase of juvenile fish recruitment into the lake. MFLNR indicated that the Conceptual Fish Habitat and Fishery Offsetting Plan was adequate for the EA and that MFLNR should be further consulted during the development of the final plan for the *Fisheries Act* authorization, should Ajax proceed.

SSN, DFO, MFLNR, MOE, and the City of Kamloops requested quantification of habitat loss from the diversion of Peterson Creek around the mine pit and potential downstream flow reduction effects to fish habitat in lower Peterson Creek. In response, KAM undertook further assessment of flow conditions and fish habitat modelling analysis in lower Peterson Creek. During the EA process, KAM also redesigned the Peterson Creek Diversion System to minimize direct habitat loss and reduce the length of the diversion from 3.6 km (identified in the EIS/Application) to 2.7 km. KAM noted that flow reduction effects to fish habitat in lower Peterson Creek would be minimal relative to baseline conditions. KAM committed to continue engaging with SSN, MFLNR, and DFO during permitting to refine the final Fish Habitat and Fishery Offsetting Plan in order to maintain or improve the productivity of recreational and Aboriginal fisheries.

4.3.4 WATER CIRCULATION AND DISSOLVED OXYGEN

DFO raised a concern that water circulation and dissolved oxygen might not be sufficient to support fish habitat in the expanded west arm of Jacko Lake. KAM responded that the depth of the access connector channel would match depths in Jacko Lake and be fitted with a low level outlet to promote subsurface circulation and to prevent low dissolved oxygen levels. KAM noted that should dissolved oxygen become an issue, the channel could be dredged.

4.3.5 FLOW REDUCTIONS IN LOWER PETERSON CREEK

DFO, MFLNR, MOE, and SSN were concerned that stream flow reductions could affect fish populations (e.g. Rainbow trout, Coho salmon, and Chinook salmon) in lower Peterson Creek at the confluence with the South Thompson River. KAM proposed several options to mitigate reduced flows in Peterson Creek during construction, operations, and closure, such as pumping water from Kamloops Lake into Jacko Lake, redirecting some flows from Keynes Creek and Humphrey Creek, and supplementing outflows from Jacko Lake. KAM is considering options for streamflow mitigation during the post-closure phase, including transferring of water licences from existing licence holders. KAM is committed to mitigating impacts to streamflow that considers the needs of licence holders and fish and fish habitat through further discussion with MFLNR, DFO, and SSN. Further discussion on surface water quantity and streamflow mitigation measures are described in section 2 of the Report.

The Agency and EAO note that the change in water quantity in Peterson Creek downstream of the mine site would not result in residual effects to fish and fish habitat. The Agency and EAO note that any further measures proposed by KAM in the future to mitigate streamflow reductions would further reduce effects to fish and fish habitat.

4.3.6 *Water Quality in Peterson Creek*

MOE and ECCC raised concerns regarding potential water quality effects to fish and aquatic life in Peterson Creek. MOE's assessment identified potential water quality effects in lower Peterson Creek (from Humphrey Creek to Long Lake Road Crossing), on:

- Rainbow trout reproduction due to high nitrate levels;
- Chronic effects on the aquatic food chain in the Peterson Creek watershed from high selenium and sulphate levels, and on health, growth, and/or reproduction of aquatic life (fish and its food chain) due to high aluminum and copper values; and
- Mortality of local green algae as part of the food chain due to high arsenic concentrations.

KAM disagreed with a number of MOE's conclusions regarding the potential effects to ecological receptors from changes to water quality, stating that MOE's assessment did not adequately consider duration and timing. In particular, KAM noted that elevated concentrations of many parameters are predicted to occur during December and January, when surface flows are typically low to non-existent in some parts of lower Peterson Creek. Additional information on issues raised related to water quality is provided in section 2 of the Report.

4.3.7 *Water withdrawal from Kamloops Lake*

DFO, MFLNR, SSN, and the public raised concerns about the potential effects of water extraction from Kamloops Lake on fish and fish habitat, particularly during low flow periods. KAM stated that water withdrawal from Kamloops Lake for operations during extreme low flows would result in a maximum width reduction of 21cm (0.003% of the total width) and a reduction in depth of less than 0.5 cm in the shallowest transect of the Thompson River at the outlet of Kamloops Lake, which would be unlikely to affect fish behaviour or fish habitat. The Agency and EAO are of the view that Ajax water withdrawals from Kamloops Lake would not result in residual effects to fish habitat in Kamloops Lake and downstream in the Thompson River.

4.3.8 *Kamloops Lake Intake*

DFO, MFLNR, and SSN expressed concern that the approach velocity at the Kamloops Lake Water Intake would exceed DFO's Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995) due to the high extraction. This exceedance could cause fish mortality due to impingement or entrainment at the water intake screen. KAM outlined the measures that would be taken to avoid fish impingement or entrainment, which include the use of appropriate screen sizes, and maintaining the lowest possible approach velocity. KAM stated that the intake would not result in impacts on rearing habitat for salmonid species in Kamloops Lake.

DFO stated that it was satisfied with the information provided for the purposes of the EA, and that KAM would be required to provide additional information for further development of the Fish Habitat and Fishery Offsetting Plan for the *Fisheries Act* authorization.

4.3.9 SSN SPRING TROUT FISHERY

SSN identifies Jacko Lake and the surrounding area as having cultural and spiritual significance and is of the view that there are no acceptable mitigation measures for impacts to Jacko Lake. SSN is also concerned that Peterson Creek would be permanently altered, and that the temporary diversion would result in impacts to SSN's annual spring trout fishery. Impacts to SSN's fishing practices are discussed in detail in Part C and in Current Use of Lands and Resources for Traditional Purposes (section 18) of the Report.

4.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

4.4.1 FISH AND FISH HABITAT

In consideration of KAM's proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in the following residual effects to fish and fish habitat:

- Habitat loss in Jacko Lake and Peterson Creek from development of the open pit; and
- Fish mortality from installation of the sheet pile dam in Jacko Lake.

The Agency and EAO are of the view that Ajax would result in a residual effect on fish habitat due to the direct loss of 10.38 hectares of habitat in Jacko Lake and Peterson Creek. Direct habitat loss in Jacko Lake and Peterson Creek would be limited to the Ajax footprint. Habitat loss within the northeast arm of Jacko Lake would be permanent. Habitat loss in Peterson Creek from the diversion around the open pit would be long-term (30 years) during the construction and operations phase, and would be reversible following restoration of habitat in the decommissioning and closure phase.

The Agency and EAO agree that the loss of fish habitat in Jacko Lake and Peterson Creek could be offset through implementation of the proposed Fish Habitat and Fishery Offsetting Plan, subject to approval of DFO, as required for a *Fisheries Act* authorization. KAM has committed to involving MFLNR and Indigenous groups, particularly SSN, in the further development of the proposed Fish Habitat and Fishery Offsetting Plan.

With the implementation of proposed mitigation measures, the Agency and EAO conclude that the residual effects of Ajax as a result of direct and indirect habitat loss would be low in magnitude, local in extent, and long-term to far future in duration throughout the life of Ajax. Residual effects would be reversible, as an equivalent amount of fish habitat would be available following successful implementation of the proposed Fish Habitat and Fishery Offsetting Plan.

Jacko Lake provides habitat for a population of Rainbow trout, which is stocked annually. For this reason, the resiliency of the population of Rainbow trout stocked in Jacko Lake is expected to be high. Therefore, the Agency and EAO agree with KAM that the Ajax would not result in a measurable change in the population of Rainbow trout in Jacko Lake.

Installation of the sheet pile dam would be designed to keep underwater pressure and sound levels below the threshold for physical injury to fish, in accordance with the National Oceanic and Atmospheric Administration's interim criteria for the onset of physical injury to fish.

The Agency and EAO acknowledge the concerns raised during the EA regarding the potential for fish mortality or injury associated with installation of the sheet pile dam in Jacko Lake during project construction, and blasting in the open pit during operations. To address these potential effects, the EAO proposes an EA Certificate condition that would require KAM to develop and implement a Fisheries and Aquatic Life Management and Monitoring Plan that includes:

- Measures to avoid or mitigate potential mortality and injury to fish from sheet pile installation in Jacko Lake during project construction, and blasting in the open pit during project operations;
- Monitoring of sound pressure levels and sound exposure levels in the water column during blasting and sheet pile dam installation, and visual surveys on Jacko Lake to assess for potential fish injury or mortality; and
- Description of adaptive management plans and additional mitigation measures to be implemented in the event that fish injury or mortality occurs.

With the implementation of proposed mitigation measures, the Agency and EAO conclude that the residual effects of Ajax to fish mortality would be low in magnitude, local in extent, short-term during the construction phase, and reversible.

The Agency and EAO's characterization of the residual effects of Ajax on fish and fish habitat, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

4.4.2 CUMULATIVE EFFECTS

The Agency and EAO are of the view that residual effects of Ajax to habitat loss in Jacko Lake for development of the open pit would also contribute to cumulative effects to fish habitat loss in the Peterson Creek watershed. In addition, reasonably foreseeable ranching and agricultural activities could result in residual cumulative effects to fish and fish habitat in the Peterson Creek watershed. The Agency and EAO conclude that these cumulative effects to fish and fish habitat would be low in magnitude, local in extent, and long-term in duration.

4.4.3 CONCLUSION

Considering the above assessment, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to fish and fish habitat.

Taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to fish and fish habitat.

5 Vegetation

5.1 BACKGROUND

This section provides a summary of potential effects on rare and sensitive plants and plant communities, mitigation measures proposed by KAM to address those effects, and a discussion of the key issues. The assessment focuses on effects to grasslands, wetlands, and rare plants, and summarizes the key issues regarding these valued components that were raised during the EA. It also sets out the analysis and conclusions of the Agency and EAO regarding Ajax's potential adverse effects to grasslands, wetlands and rare plants.

As grasslands and wetlands provide habitat for wildlife species at risk, the results of this section are considered in Wildlife (section 6) and Part C (impacts to Aboriginal Interests) of the Report.

5.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

5.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

Ajax is located in the Thompson-Okanagan Plateau Ecoregion within the Thompson Basin Ecosection, which is a warm and exceptionally dry, broad low elevation basin. Wetlands in the area consist of marshes, open shallow water, and swamps. The vegetation and plant communities in this ecosection reflect the warm, dry climate within the bunchgrass zone.

The local study area for grasslands, wetlands, and rare plants included the Project's infrastructure footprint plus a 50 m buffer used to calculate the potential direct effects (called the infrastructure disturbance area), plus a further 500 m buffer that represents the maximum expected area of potential disturbance associated with all project facilities. The local study area was used to assess both direct and indirect project effects (e.g., impacts from invasive species). The regional study area was identified to provide a regional context for grasslands, wetlands, and rare plants, and included portions of the South Kamloops Landscape Unit and Campbell Landscape Unit, including areas south of the Thompson River and west of Highway 97.

Grasslands, wetlands, and rare plant species in the local and regional study areas have been impacted by current and historical anthropogenic activities. KAM stated that the quality and quantity of native and diverse grasslands have been eroded throughout the region and at the Ajax site, and characterized grasslands in the local study area as being moderately altered (an average estimate of 38% alteration from benchmark condition). For SSN, grasslands and the complexity and biodiversity that exist within them including both wetlands and rare plant species are of great importance. Wetland preservation is a provincial and federal priority, and those in the Ajax area have been subject to past disturbance including being drained for agriculture activities, trampled and eroded by cattle for cattle ranching, reduced in numbers for urban development, and experienced degraded functions related to forestry activities. KAM stated that while regional data is not available for most rare plant species, they assumed that the number of rare plants has declined. KAM noted that noxious weeds are widespread in the region and contribute to the degradation of native vegetation and ecological conditions.

Much of the local study area consists of a variety of grassland types including riparian and terrestrial Priority Grasslands Conservation Areas (primarily bunchgrass), delineated by the Grasslands Conservation Council of British Columbia (2009), which were mapped to identify grasslands of high value including those required for species at risk, ranching and forage, and use by Indigenous groups. Grasslands in the regional study area consist mainly of bunchgrass and sagebrush-steppe. KAM described grasslands as fragile ecosystems that are one of the rarest habitat classes in British Columbia. KAM noted that grasslands provide habitat for over 30% of BC's listed and at risk plant species.

The local study area also includes priority riparian areas such as wetted grasslands that provide unique features for wildlife such as water-associated migratory birds and plant communities, and habitat for rare plants and for wildlife, including vulnerable life stages for amphibians, and at-risk and migratory birds. The local study area supports ephemeral wetlands, that temporarily hold water in the spring and early summer or after heavy rains, and which provide important breeding habitat for amphibians including the *Species at Risk Act*-listed great basin spadefoot. In this report, the term wetland refers to both permanent and ephemeral wetlands. In total, KAM identified 131 hectares of wetlands in the local study area. Most of the permanent wetlands are located in proximity to Jacko Lake and Peterson Creek and ephemeral wetlands or small waterbodies are located largely within the linear corridors. Ephemeral wetlands were identified through mapping during the EA. KAM estimated there are at least 640 hectares and up to 2900 hectares of wetlands in the regional study area.

KAM's field studies of the local study area identified rare plants, including some plants which have not previously been identified in the region. Baseline studies identified the following:

- Sixteen provincially red- or blue-listed rare plants in the local study area: 5 vascular plants, 3 mosses and 8 lichens. Provincially designated plant species are red-listed if they are imperiled or critically imperiled; and blue-listed plants are of special concern, or they may be blue-listed because there is inadequate data available to properly assess their rarity.
- The only plant species listed under the *Species at Risk Act* that KAM identified in the local study area is alkaline wing-nerved moss; one occurrence is located near the edge of a pond within the proposed transmission line corridor. Other occurrences of alkaline wing-nerved moss were recorded near Kamloops: four within the local study area and another in the Lac Du Bois Grassland Protected Area.
- Eleven noxious weed species were identified in 209 occurrences, some covering several hectares.
- One hundred and fourteen traditional use plants that are important to Indigenous groups were identified in the local study area. All traditional plant species are considered common (provincially yellow-listed) or an introduced or exotic species, and therefore were not brought further into the vegetation effects assessment.

KAM stated that Ajax would impact rare plant occurrences, but noted that there is a high uncertainty about the broader implication of those impacts to rare plant species, because of an unconfirmed regional distribution. In particular, KAM noted that rare moss and lichens species which have not been surveyed in the regional study area may be more abundant than what was identified during Ajax-specific studies.

5.2.2 POTENTIAL EFFECTS AND MITIGATION MEASURES

The following section summarizes KAM's assessment of the potential effects of Ajax on grasslands, wetlands and rare plants and its proposed mitigation measures to avoid, reduce or offset those effects.

5.2.2.1 *Habitat Loss*

KAM stated that activities such as vegetation clearing and grubbing, land excavation, installation of dams for water management, and construction of the transmission line and waterline would cause the direct loss of a

1,700 hectare area that includes grasslands, wetlands and rare plants. Direct loss would include approximately 1,002 hectares of grasslands and 38.6 hectares of wetlands. KAM's mitigation measures for habitat loss included:

- Best management practices, including minimizing the Ajax footprint during project development;
- Implementation of compensation and offsetting measures for both wetlands and grasslands during construction and operations; and
- Implementation of a Reclamation and Closure Plan that includes progressive reclamation and revegetation of the site over the mine life, using native seed mixes and reclaiming 1,440 hectares (the mine site, minus the open pit), primarily as grasslands, during decommissioning and closure phases.

5.2.2.2 *Habitat Alteration*

KAM stated that Ajax would cause habitat alteration, and therefore reduced habitat suitability for grassland and wetland reliant plant and animal species, of areas immediately adjacent to but outside of the Ajax footprint. Habitat degradation could occur in this area as result of soil compaction and reduced soil porosity, linear feature use and maintenance, changes in drainage and water quantity, or exposure to dust and trampling. KAM also stated that habitat suitability could be reduced due to the introduction of and competition from invasive species in the local study area. KAM's mitigation measures for habitat alteration included:

- Implementing monitoring and management plans for erosion and sedimentation, fugitive dust management, site access, transportation, surface water and groundwater quality, and water management and hydrometric monitoring;
- Implementing an invasive species management plan that includes revegetating disturbed areas with native seed mixes, inspecting vehicles for invasive species, washing vehicles to remove invasive species, and direct removal of invasive species; and
- Treating 629 hectares prior to construction, primarily in the local study area, to reduce invasive species and avoid further spread during construction.

5.2.2.3 *Grasslands*

KAM predicted that the construction of Ajax would result in the loss or alteration of up to 2,192 hectares (66%) of a total of the 3,322 hectares of grassland habitat in the local study area, all of which were considered priority grasslands. KAM stated that of this area, 1,002 hectares of grasslands would be lost within the Ajax footprint, 775 hectares may experience habitat alteration or deterioration as a result of construction activities and linear feature maintenance, and up to 414 hectares of grasslands in the local study area could experience altered or degraded habitat because of increased invasive species. KAM said that, within the regional study area, grassland habitat loss represents removal of approximately 3% of priority grasslands which include riparian priority areas, terrestrial priority areas, and working landscape grasslands. KAM stated that approximately 60% of open grasslands in the regional study area are considered priority grasslands.

Over the long-term, KAM would restore 1,125 hectares of grassland habitat through reclamation and revegetation processes as part of the Landscape Restoration Plan. Reclamation during operations, closure and post-closure would be designed to approximate grassland topography and species composition in the local study area. The 299 hectare open pit area would not be reclaimed.

To address the habitat loss and alteration impacts to grasslands and grassland-dependent plant and animal species during construction and operations, KAM proposed to develop and implement a grassland restoration and enhancement program on 2,093 hectares of KAM-owned land west of the Ajax infrastructure disturbance area but still within the regional study area. This land currently contains some grasslands as well as a mixture of young open forest and shrub sage-brush dominated grassland. The proposed treatments would include forest and sage-brush thinning and invasive plant removal. The program is described in Appendix B of KAM's draft Wildlife Management and Monitoring Plan. Prior to implementation of this program, KAM stated they would conduct a grassland conditions assessment and proposed to partner or consult with the City of Kamloops, the Grasslands Conservation Council of British Columbia, local landowners, tenure holders and Indigenous groups to identify priority enhancement areas and actions within the regional study area. As part of grasslands care and mitigation of effects from Ajax, KAM has proposed to include management measures for over-grazed sites such as implementing lighter cattle stocking, longer and more effective rest periods, and improved rotational grazing on KAM-owned land in areas adjacent to the mine infrastructure footprint.

5.2.2.4 *Wetlands*

Wetlands would be completely lost, or experience alteration or impaired functionality due to soil compaction, changes in drainage, and chemical hazards in the infrastructure disturbance area. KAM predicted that Ajax would result in the loss of 35.1 hectares of permanent wetlands and 3.5 hectares of ephemeral wetlands. Approximately 26 hectares of permanent and 4.9 hectares of ephemeral wetlands could be altered. In total, approximately 29% of wetlands in the local study area would be lost, and 24% altered. Within the regional study area, KAM estimated that the loss and alteration of wetlands would be between a 2.5% and 11% loss of the estimated available wetlands in the regional study area.

Of the wetlands affected by the Ajax footprint, KAM stated that 10.1 hectares are subject to the *Federal Policy on Wetlands Conservation*, because they are critical habitat for great basin spadefoot toad (discussed in section 6) and alkaline wing-nerved moss. For these wetlands, KAM proposed to implement a Wetland Compensation Plan designed to achieve like-for-like offsetting of wetland function loss at a replacement ratio of 2:1. In total, KAM proposed to create 28.7 hectares of wetlands. As part of developing the Wetland Compensation Plan, KAM would conduct additional wetlands surveys to assist in designing the plan. KAM would initially focus their efforts on local wetlands and enhancement around the verges of Jacko Lake and proposes to create additional wetland habitat in combination with the proposed Fish Habitat and Fishery Offsetting plan that is required by DFO. The Wetland Compensation Plan would incorporate monitoring and follow up.

KAM stated that they would re-route linear components to avoid effects on wetlands and waterbodies and would successfully avoid four waterbodies along the power line corridor and three wetlands along the waterline.

After the implementation of mitigation and the Wetland Compensation Plan, a loss of 10 hectares of ephemeral and permanent wetlands would remain, representing approximately 7.6% of wetlands in the local study area and between 0.3% and 1.5% of wetlands in the regional study area.

5.2.2.5 *Rare Plants*

Of a total of 55 rare plant species occurrences found in the local study area, approximately 70% were in the infrastructure disturbance area. Within the infrastructure footprint 35% of those would be lost and 36% subject to alteration of their habitat. Table 5.5-3 lists rare lichens, mosses and herbaceous plants that would be impacted, and shows their relative known abundance within the local study area, the infrastructure development area, and the infrastructure footprint.

KAM predicted that, with the implementation of mitigation measures to address habitat alteration from fugitive dust, invasive species, water quality (heavy metals), and soil compaction effects, Ajax would not adversely alter the rare plant habitat outside the infrastructure footprint. However, KAM assumed that the single occurrence of alkaline wing-nerved moss could be lost during construction; although the physical location of the moss would not be disturbed, it is associated with a federally protected wetland that has been conservatively assumed lost. KAM mapped potential critical habitat for alkaline wing-nerved moss in the local study area and estimated that one of five occurrences in the local study area would be lost due to alteration of habitat adjacent to the infrastructure footprint, in the infrastructure disturbance area.

Table 10: Distribution of Occurrences of Rare Plants

Common name	BC Listed[21]	Occurrences in local study area, but outside of the IDA	Within the Infrastructure Footprint (IF)	Within the infrastructure disturbance area (IDA) but outside of the IF
Mosses				
Alkaline wing-nerved moss[22]	Blue (S2S3)	4		1
Sheathing pondweed	Blue (S2S3)		1	
Willow feathermoss	Blue (S2S4)			1
Vascular Plants				
Suksdorf's broomrape[23]	Red (S1)	10	10	10
Blue grama	Red (S2)		1	1
Ovalpurse	Blue (S3)		1	1
Wedgescale orache	Blue (S3)		1	1
Hall's willowherb	Blue (S2S3)	1		
Lichens				
Stegonia moss	Red (S1S2)		1	
Ten-cent tarpaper	Red (S1)		1	
Grinning rosette	Blue (S3)		1	3
Powder-lined rock-olive	Red (S1S2)		1	
Goldnugget sulphur	Blue (S3)		1	
Erupting toad	Blue (S2S3)			1

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[21] S1 – critically imperiled, S2 – imperiled, S3 – special concern, S4 – apparently secure. S#S# - indicated a range of uncertainty

[22] Listed as threatened under the Committee on the Status of Endangered Wildlife in Canada and Species at Risk Act

[23] The Kamloops area hosts the only known to occurrence of this species.

Common name	BC Listed[21]	Occurrences in local study area, but outside of the IDA	Within the Infrastructure Footprint (IF)	Within the infrastructure disturbance area (IDA) but outside of the IF
Jigsaw stippleback	Blue (S2S4)	1		
Lesser eye shadow	Blue (S2S3)			1
Total		**16**	**19**	**20**

KAM proposed to minimize direct impacts to known rare plant occurrences by adjusting the route of the powerline and waterline infrastructure during the final design. To facilitate avoidance of rare species adjacent to the Ajax footprint, KAM would identify and flag exclusion areas for rare plants located adjacent to construction and operation activities and require construction personnel to avoid the exclusion areas. KAM would limit the use of broadcast spraying intended to control invasive species and, within 200 m of known rare plant occurrences, would avoid the use of herbicide sprays. KAM would monitor protected rare plant locations to avoid impacts during operations and maintenance activities. Where avoidance is not possible, KAM would attempt relocation of rare plant occurrences.

KAM concluded that, following mitigation, 35% of identified rare plant occurrences would be lost in the infrastructure footprint. As the loss of rare plants is high relative to the number of rare plants identified in the local study area and considering that some rare plants were only found in the mine footprint, KAM stated these losses could affect the regional populations of those plants but that the distribution of those populations is not currently documented.

For Alkaline wing-nerved moss, KAM proposed a series of specific mitigation measures to avoid and protect occurrences including the identification of suitable transplant sites. KAM committed to research the regional distribution of this plant species and stated that mitigation measures may be able to protect all but one occurrence of the moss.

5.2.3 PROPONENT'S CONCLUSIONS ON RESIDUAL EFFECTS

KAM concluded that, after implementation of mitigation measures, Ajax would result in the long-term but reversible loss and alteration of grasslands within the regional study area, a permanent loss of 29% of permanent and ephemeral wetlands in the local study area, and a permanent loss of rare plant occurrences which could have population-level effects to some rare plant species.

5.2.4 CUMULATIVE EFFECTS

KAM stated that timber harvesting and agricultural expansion are ongoing activities that could further degrade grasslands and wetlands, and result in the loss of rare plants and their habitat, but did not quantify the effects to vegetation from these activities. These activities could overlap both temporally and spatially with Ajax activities.

KAM identified two reasonably foreseeable activities that could interact with or compound habitat loss and alteration caused by Ajax on grasslands, wetlands or rare plants: expansion of the City of Kamloops particularly Aberdeen; and twinning of Kinder Morgan Canada's TMX pipeline.

Regarding the expansion of the City of Kamloops, the local area plan for Aberdeen, which is located northeast of Ajax and adjacent to the regional study area, indicates that Aberdeen is expected to continue expanding from an approximate population of 10,000 people in 2011 to over 16,000 by 2036. KAM stated that this activity could remove similar types of habitat, including grasslands, wetlands, and known and unidentified rare plant occurrences, but that some areas located in Aberdeen are deemed environmentally sensitive areas in the City of Kamloops Official Community Plan (KAMPLAN). KAM stated that environmental protection measures for these areas as well as unmapped wildlife, aquatic and riparian habitat areas are described in section VII-4 of KAMPLAN. Measures include preservation of environmentally sensitive areas and the use of development approval processes to evaluate development proposals in the area, bylaw enforcement, and guidelines such as the Land Development Guidelines for the Protection of Aquatic Habitat and Stream Stewardship. The expansion of the City of Kamloops would not spatially overlap with Ajax, but should both occur, their residual effects could occur simultaneously. It is possible, but unknown, if specific expansion activities would temporally overlap with Ajax.

The twinning of Kinder Morgan Canada's TMX pipeline and rerouting of the pipeline through the Ajax regional study area is anticipated to result in a temporary loss and alteration of habitat. The loss or altered habitat would be re-vegetated within a short period of time, and therefore the impacts would be fully reversible over the long-term. It is possible, but unknown, if the expansion and installation activities would occur during the same timeframe as the Ajax construction. KAM assumed that TMX would be subject to regional management direction, such as the Kamloops Land Resource Management Plan, and would follow general best practices, such as avoiding effects on sensitive plant communities including grasslands, preventing the spread of invasive species, and minimizing habitat losses.

KAM stated that some loss of grasslands, including red- and blue-listed communities and Priority Grassland Areas, would not be mitigated and may result in a cumulative effect in combination with other activities. Since habitat loss may not be fully mitigated, residual cumulative effects to grasslands would remain.

KAM stated that awareness of wetland importance and stewardship is increasingly offering some protection to remaining wetlands. KAM stated that while Ajax's effect to wetlands may not be fully mitigated, the regional effect of Ajax on wetlands would be minimal. KAM did not anticipate a cumulative impact to wetlands from interactions with other projects and Ajax.

KAM stated that the identified activities would exacerbate effects to rare plants and result in the loss of habitat types that could support rare plants, and that these effects would cumulatively interact with similar Ajax residual effects. KAM noted that loss of rare plants in the local study area due to Ajax may have an adverse effect on the local or regional populations of those plants, in combination with other foreseeable activities, and ranked the potential cumulative effects as high. KAM noted that additional surveys in the regional study area would likely substantially reduce this ranking, given the low confidence in the predictions due to a lack of regional data for rare plants. KAM stated they would partner with provincial agencies and other stakeholders to support regional rare plant surveys and give better clarity about the regional abundance of rare plant species. KAM predicted that such surveys would show that there are regional populations of rare plants which are currently unidentified.

5.2.5 MONITORING AND FOLLOW-UP

5.2.5.1 *Grasslands*

KAM proposes a follow-up and monitoring program to determine the effectiveness of the proposed mitigation measures to reduce, off-set, or avoid effects to grasslands. KAM will implement a grassland restoration and enhancement program, including monitoring and adaptive management, as reflected in Appendix B to the Wildlife Management and Monitoring Plan and as part of the post-closure Landscape Restoration Plan. Follow-up will include:

- Assess grassland condition to determine priority areas and actions for grassland restoration and enhancement;
- Implement grassland monitoring to assess the success of the various reclamation and compensation treatments for a five year period and implement additional reclamation strategies based on results; and
- Monitor restored grasslands until all revegetated areas have met end land use objectives post-closure.

5.2.5.2 *Wetlands*

KAM would implement a Wetland Compensation Plan outlined in KAM's memo *Application of the Federal Policy on Wetland Conservation* (July 25, 2016). Monitoring associated with this plan would occur over a number of years to confirm that compensation meets the intent of Canada's *Federal Policy on Wetland Conservation* achieving full wetland functionality (including habitat functions for migratory birds, fish and fish habitat and species at risk) at a 2:1 ratio of compensated areas to impacted areas. Monitoring would include the following:

- Monitor at Peterson Creek to determine whether further wetland compensation is necessary to mitigate the effects of reduced flows downstream of the mine site;
- Conduct a follow-up program to verify the effective functioning (hydrological, biochemical, diversity and habitat) over time, comparing with baseline survey results, and adaptively managing the wetland offsetting with advice from DFO, ECCC, MFLNR, MOE, and Indigenous groups to identify appropriate further action and adaptive management, where needed;
- Monitor concentration of dissolved metals within Peterson Creek and Humphrey Creek, as well as the vegetation along these wetlands, to determine if chemical elements are accumulating that could harm wetland-associated plants or animals;
- Monitor the success of active management of wetland plant species composition, removing invasive species and, where necessary, planting native and traditional use plants;
- Monitor metal concentrations in water bodies to assess the concern raised regarding the effect of chemical hazards on the functioning of wetlands; and
- Track ecosystem succession.

5.2.5.3 *Rare Plants*

KAM proposes a follow-up and monitoring program for rare plants to monitor the success of revegetation, rare plant transplantation, and control of invasive species. Monitoring would include the following:

- Conduct pre-construction surveys in the areas where rare plants have been identified to ensure sufficient data is collected to pinpoint rare plant occurrences in the area of disturbance as well as within the regional study area;
- Conduct annual monitoring for alkaline wing-nerved moss populations within the infrastructure disturbance area from construction through mine closure; and
- Monitor any translocations of rare plants for up to ten years to assess the success of translocation efforts.

KAM proposed a follow-up program to verify the effectiveness of mitigation measures for rare plants and to implement adaptive management based on results. This program would include follow-up for alkaline wing-nerved moss to verify the effective functioning of any translocation efforts, and the success of marked no-work exclusion zones in protecting this species at risk.

5.3 DISCUSSION OF ISSUES

During the EIS/Application review phase, members of the working group and the public raised concerns related to the potential effects of Ajax on vegetation and ecological communities. This section provides a summary of the key issues raised and KAM's responses.

SSN, MFLNR, and ECCC maintained at the drafting of the Report, that there are outstanding data gaps, and insufficient baseline data, which has led to uncertainty in assessing the adequacy of mitigation measures and reduced confidence to assess potential effects. The City of Kamloops identified concerns with sampling protocols, and stated that the survey results are insufficient to properly characterize baseline conditions and the effects assessment.

The Agency and EAO understand that the supplemental information provided by KAM during the EA review process did not satisfy the concerns raised by SSN, MFLNR, ECCC and the City of Kamloops. To fill the data gaps and reduce uncertainty, EAO has proposed a series of EA Certificate conditions to be developed in consultation with SSN, MFLNR, ECCC, and others. KAM would be required to conduct more detailed field surveys and further develop the draft management and monitoring plans. Rigorous monitoring during all phases of Ajax would be required to verify predictions and enable pre-determined adaptive management actions.

5.3.1 RARE PLANTS: BASELINE SURVEY METHODS AND INTENSITY

SSN, MFLNR, ECCC, the City of Kamloops, and the public commented that the survey efforts, adequacy of terrestrial ecosystem mapping and the level of detail obtained through baseline surveys were inadequate, and therefore the confidence in the predictions were insufficient to inform decision making for Ajax impacts to rare plants and rare plant communities. Additional baseline data was requested for the linear corridors (waterline and transmission line areas) which had not been surveyed and for the regional study area to provide a better regional context.

KAM responded that, where their habitat mapping identified potential rare plant habitat but field surveys were unable to substantiate the information, they took a conservative approach and assumed that the habitat was being used and therefore would require protective measures. KAM also committed to collecting additional baseline data for rare plants prior to construction within linear corridors. KAM provided additional information about critical habitat of alkaline wing-nerved moss and the appropriate implementation of a mitigation hierarchy in response to concerns.

SSN, MFLNR and ECCC maintained that because KAM did not collect or have available data to reflect the complexity of the rare plant species at the site or in the region, it would be difficult to conclude accurately on the impacts from the Ajax on rare plants. MFLNR recommended that additional surveys be conducted throughout the local and regional study areas including the linear corridors, following acceptable scientific standards and the subsequent development of appropriate mitigation measures which consider BC's Environmental Mitigation Policy hierarchy, to minimize and avoid effects to rare plants.

5.3.2 Mitigation measures for Red and Blue-listed Rare Plants

MFLNR, ECCC, the City of Kamloops, SSN, and the public raised concerns about a lack of confidence in the mitigation measures for protecting rare plants located in the infrastructure disturbance area that would result from habitat loss and alteration. SSN stated that the loss of rare plants at Ajax is of high significance to them. These groups recommended KAM provide additional mitigation and develop a rare plant offsetting and compensation plan to address residual impacts to rare plants. In response, KAM committed to conduct regional rare plant surveys and research to determine the distribution of these rare plants species throughout the regional study area and to support additional mitigation.

5.3.3 Critical habitat for Species at Risk Act-listed Plant Species

ECCC raised concerns and questions related to Ajax's potential impacts to the critical habitat of *Species at Risk Act*-listed plant species, the alkaline wing-nerved moss. ECCC provided KAM with draft critical habitat information for alkaline wing-nerved moss during the review of the EIS/Application, to support further analysis by KAM.

KAM assessed potential critical habitat for alkaline wing-nerved moss, and identified habitat areas in the local study area using terrestrial ecosystem mapping and Vegetation Resources Inventory comparable biophysical attributes for the moss. KAM's analysis resulted in the identification of potential critical habitat in the local study area and project footprint and identified one of four occurrences that may be lost because it is located adjacent to the Ajax footprint. KAM committed to monitor alkaline wing-nerved moss populations within the Ajax area annually from construction until the end of decommissioning and closure. MFLNR recommended that KAM implement BC's Environmental Mitigation Policy hierarchy, to minimize effects to alkaline wing-nerved moss, including, if necessary the development of offsetting to reduce impacts to this species.

5.3.4 Grasslands Mitigation Measures

Grassland Habitat Continuity during Mine Operations

SSN, MFLNR, and the Grasslands Conservation Council of British Columbia expressed concern that post-mining reclamation may not be as effective as KAM predicts and would not address the needs of displaced grassland-dependent species, or the loss of red- and blue-listed ecosystems over the life of Ajax. Additionally, these groups stated there is little certainty regarding the successful reclamation of grasslands unique to the Thompson-Nicola region, as the native grassland species can be challenging to re-establish on a native soil base, and perhaps more so on an impoverished soil base or a mineralized substrate, or in disturbed areas where rootstock is lost. To address these uncertainties, MFLNR and the Grasslands Conservation Council recommended that KAM be required to develop additional offset / compensation for the loss of grasslands at a 2:1 ratio, that additional reclamation techniques, such as plugs, be used for reclamation, and that grasslands reclamation be actively managed to the point where it is self-sustaining.

KAM proposed a grassland restoration and enhancement program on KAM-owned land west and north-west of the mine site, to improve the extent and functionality of available grasslands by reducing invasive species and reducing habitat encroachment. KAM stated that this program would help reduce the impacts of habitat loss and alteration to grasslands and associated species that would result from Ajax. The total area identified as potentially suitable for the identified restoration treatments is 2,093 hectares which includes: 629 hectares of invasive plant control; 1,077 hectares of young forest thinning; 367 hectares of sagebrush density thinning; and 20 hectares where riparian fencing would be installed.

MFLNR and the City of Kamloops agreed that the grasslands restoration program would provide some ecological benefits, but maintained that there is high uncertainty regarding the success of the proposed restoration of grasslands. MFLNR noted that the proposed grassland compensation area contains forested, rocky and sage-brush dominated areas and is consequently not representative of the bunchgrass dominated grasslands which would be lost due to Ajax. MFLNR stated that it would take long-term sustained management action to restore the proposed offsetting areas to functional grasslands capable of supporting multiple species at risk life requisites. To address the temporal loss of grasslands, MFLNR recommended that offsets be in place for at least the duration of the impact (i.e. the duration of the mine life plus the time for the grassland reclamation on the mine site to be effective). MFLNR recommended that potential offset areas should consist of existing healthy grassland habitat, including areas with existing populations of grassland species, particularly species at risk, and that current and future land use activities occurring at these offset areas are compatible with maintaining current grassland habitat conditions.

SSN indicated that the complexity of the grassland system at the site was not adequately assessed, and that there was also no assurance that the level of complexity at Ajax was available and accessible elsewhere. SSN indicated that the loss of this grassland is a high and significant loss to them and remained an outstanding concern.

Invasive Species Management

MFLNR, the City of Kamloops, SSN, the Grasslands Conservation Council of British Columbia, and the public did not agree with KAM's determination that impacts to grasslands by Ajax from invasive species would be low. MFLNR recommended that KAM commit to a program of monitoring for invasive species and to ensure early detection to implement a rapid response, as suggested by British Columbia Invasive Plant Strategies, when encountering a new invasive species which would enable the best success for reduction of introduction and spread of invasive plants. KAM responded that they would implement proactive invasive plants management, focused within the infrastructure disturbance area, and would conduct biannual monitoring of invasive plant species in cleared sites, as well as observational monitoring to identify the encroachment of invasive species as part of the implementation of their Invasive Species Plan. KAM also stated that cleared sites would be promptly revegetated to reduce the potential of invasive plant species establishment, as suggested by the British Columbia Invasive Plant Strategies to reduce the potential of invasive plant species establishment. KAM committed to working with the Southern Interior Weed Management Committee (SIWMC) to ensure invasive species control at Ajax would be informed by and aligned with regional practices.

Post-closure Reclamation and Revegetation with Native Species

SSN, City of Kamloops, MFLNR, and the public raised concerns about the loss of grasslands over time, the likely success of recolonization of grassland areas during reclamation, and the sufficiency of a 10 year-post reclamation monitoring program. The Grasslands Conservation Council of British Columbia also raised concerns about the details for reclamation monitoring and the probability of reclamation success, and suggested that KAM commit to active management of the grassland reclamation areas for the period of time it will take to recover, which could be 25 years or more. There were particular concerns that grasslands would not reflect native plant species composition, especially if KAM allowed grazing in recolonization areas. Further, the Grasslands Conservation Council of British Columbia recommended that KAM use native seed stock and plugs in mitigation activities for reclaiming native grassland areas.

KAM responded that they are committed to restoring grasslands until they reach a stage of development that provides a high probability of continued, ecologically sustainable presence and self-maintenance. KAM also stated that they would use reclamation seed mixes which are adaptable to a wide range of environmental conditions and include ecologically and culturally-important native grass species common to the Ajax site.

5.3.5 WETLANDS

Ephemeral Wetlands

MFLNR, SSN, and the City of Kamloops expressed concern that ephemeral wetlands were not quantified or assessed in the EIS/Application. SSN noted that ephemeral wetlands provide life history and trophic structure important to endemic organisms of the Thompson-Nicola region. SSN stated that the unique biodiversity of the area is closely associated to small wetlands areas scattered across the region.

KAM provided supplemental assessment that identified additional ephemeral wetlands through mapping and reassessed the impacts to wetlands through the incorporation of the loss of a further3.5 hectares and alteration of 8.4 hectares of ephemeral wetlands. The City of Kamloops indicated that because this supplemental information was not obtained through multi-year sampling, it could be an underestimate of ephemeral wetlands and amphibian habitat, and may not accurately reflect what exists at Ajax.

Wetland Compensation

ECCC expressed concern that KAM's proposed wetland compensation would not achieve a no-net-loss of wetland functions. KAM responded that, effectively with a total of 10 hectares of critical habitat wetlands lost, their proposed 28.7 hectares of compensation wetlands represents a ratio of greater than 2:1 for those wetlands for which they would be required to compensate for under the Federal Wetland Policy. MFLNR recommended that the compensation plan be available during EIS/Application review to inform the assessment of residual effects to wetlands, including those that support species at risk and spring migratory bird habitat adjacent to Peterson Creek and larger waterbodies. SSN requested that compensation efforts for wetlands lost in the Ajax footprint mimic the ecological function provided by small ephemeral systems as opposed to deep lake water systems or riparian areas.

KAM agreed to develop a Wetland Compensation Plan that includes measures to protect wetland dependent species in the local study area. The objective of the compensation program would be to achieve like-for-like offsetting of wetland function loss for critical habitat.

ECCC stated that the proposed wetland compensation plan would require a follow-up program aimed at monitoring planted vegetation, designed to assess the success of hydrologic function for wetlands, and to ensure wetlands are meeting needs of migratory birds which use wetlands.

5.3.6 *MONITORING PLANS*

SSN stated that KAM's Wildlife and Vegetation Monitoring Plan (section 11.27 of the EIS/Application) should have included biologically important effects or thresholds for monitoring, so that there would be clarity on effects deemed unacceptable. KAM responded that specific monitoring metrics to identify effects to vegetation and wildlife would be developed as part of permitting applications, which would further develop mitigation measures outlined in KAM's February 17, 2017 Wildlife Management and Monitoring Plan.

5.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

After considering all relevant proposed mitigation measures, the Agency and EAO conclude that Ajax would result in the following residual effects on vegetation and ecological communities:

- Direct loss and alteration of grasslands, including those that contain red- and blue-listed species;
- Direct loss and alteration of wetlands including ephemeral wetlands; and
- Direct loss of rare plants and their habitats.

As discussed in section 5.3, the Agency and EAO understand that working group members raised concerns regarding insufficient baseline information, uncertainty in the effectiveness of mitigation measures, and confidence in the assessment. The EAO has proposed an EA Certificate condition that would require that KAM complete supplemental pre-construction vegetation surveys, developed in consultation with relevant government agencies and SSN, which would support the development and implementation of mitigation measures for vegetation.

5.4.1 *GRASSLANDS*

The Agency and EAO note that grasslands are rare and vulnerable to impacts, that they provide habitat for plant and animal species at risk, and are used by Indigenous groups for both food and medicinal plants. Disturbed grasslands take decades to regenerate after disturbance because they exist in a difficult climate with dry growing conditions, and due to historical and current effects from grazing and other human activities at the Ajax site, may be even less resilient. However, the Agency and EAO also note that parts of the Ajax site have previously been disturbed by mining and historically reclaimed to an extent that they currently provide moderate value grassland habitat for plants and animals.

The construction and operation of Ajax would cause habitat loss (1,002 hectares) or alteration (775 hectares from project activities and 414.4 hectares from invasive plants) on up to two-thirds (66%) of largely bunchgrass grasslands in the local study area, which are considered Priority 1 grasslands due to their potential to support red- and blue-listed species that are not resilient to change. Within the regional study area, 2.6% of grasslands would be directly lost and a maximum of 5.7% of grasslands would be lost or altered including areas affected by invasive species encroachment. From the perspective of SSN, this loss of grassland is high and significant.

The Agency and EAO acknowledge KAM's proactive approach to managing invasive species which are abundant at the Ajax site. The EAO proposes a number of EA Certificate conditions that include aspects of managing invasive plants, including that the Construction Environmental Management Plan address invasive plant management.

The Agency and EAO are of the view that KAM's proposed grassland enhancement and restoration treatment would partially compensate or offset for the loss and alteration of grassland habitat in the medium to long-term, by cultivating conditions more favourable to grasslands-dependent plant and animal species note that it may take a decade or more for the restoration treatments to be effective and may also require ongoing maintenance to sustain their condition as grasslands. The Agency and EAO agree with MFLNR that the proposed grassland treatment areas do not mirror the type of grasslands that would be directly lost at the Ajax site. The Agency and EAO are of the view that because there is uncertainty in the timeframe and actions necessary to achieve full grassland function, effective grassland enhancement and restoration would require clearly defined actions, monitoring and ongoing adaptive management. As a result, the EAO proposes an EA Certificate condition that would require KAM to develop and implement a Grasslands Restoration and Enhancement plan, which would include monitoring and adaptive management of the grassland restoration treatments until they reach a stage of development that provides a high probability of continued, ecological sustainability or until mine site restoration reaches the same after the end of the mine life.

The Agency and EAO acknowledge KAM's closure objective of recontouring and restoring the site to a natural condition that is ecologically sustainable and able to support grassland-dependent species, and to reclaiming an area of grasslands that is slightly larger than what would be lost in mine development. Reclamation would be undertaken progressively, and be fully implemented during the closure phase. Reclamation to native grasslands with ecologically sustainable function is expected to take decades following mine closure. The Agency and EAO note KAM's commitment to work with Indigenous groups and other stakeholders to consider alternative means and adaptively manage reclamation and closure. At the time of closure, KAM's conceptual Closure and Post-closure Planning, as required for the *Mines Act* permit, would be developed in consultation with the provincial government, Indigenous groups, and stakeholders.

The Agency and EAO considers that the residual effects of Ajax on grasslands would be medium in magnitude, local in extent, and occur into the far future (into the post-closure phase). The loss of grasslands would be irreversible, as reclamation is expected to create grasslands that would be useful to some animal species, but would not replicate the complex soil and ecological conditions that currently exist at Ajax.

Considering the above assessment, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to grasslands.

5.4.2 *WETLANDS*

The Agency and EAO recognize that 39 hectares of wetlands would be directly lost (29% in the local study area) as a result of Ajax and another 31 hectares would be potentially altered (24% in the local study area). Together this represents over half of the wetlands available in the local study area, and is estimated to represent between 2.5% and 11% of available wetlands in the regional study area.

The Agency and EAO acknowledge that KAM proposes to develop a Wetland Compensation Plan, which would be designed to compensate for the loss of those wetlands that are subject to the *Federal Policy on Wetlands Conservation*. This applies to 10 hectares of permanent red-listed and blue-listed wetlands. The Wetland Compensation Plan would provide 28.7 hectares of like-for-like compensation of federally protected wetlands lost during construction and operations, and a monitoring program until it reaches full functionality, however, KAM provided limited conceptual information about their proposed wetland compensation measures. The Agency and EAO note that after the implementation of KAM's proposed mitigation, Ajax would result in a net loss of 10 hectares of wetlands within the Ajax footprint, plus the potential alteration of 31 hectares of wetlands. As a result, the EAO proposes an EA Certificate condition that would require the development of a Wetland Offsetting Plan to offset the loss of wetland function.

The Agency and EAO agree with KAM that the wetland offsetting and compensation should be implemented as early in the project life as possible to accommodate for the time delay between the loss of wetlands and ensure that compensatory wetlands are operating successfully. The Agency and EAO note that KAM intends to implement their Wetland Offsetting Plan in conjunction with the proposed Fish Habitat and Fishery Offsetting plan, and agree that these plans should be coordinated to be effective. While the fish and fish habitat offsetting plan can augment the wetland compensation plan, the Agency and EAO are of the view that KAM will need to design and implement the wetland compensation measures to specifically address the needs of aquatic plants, amphibians and migratory birds.

The Agency and EAO note that habitat quality in wetlands could be affected by invasive species introduced by site clearing activities and by mine vehicles acting as vectors or by chemical effects from water quality changes to ground or surface water from project activities. KAM will be required through EMPR permits to actively manage invasive plant encroachment and spread, inside the infrastructure disturbance area, and also to actively manage water quality throughout the mine life and beyond. KAM has also proposed to manage invasive species in areas adjacent to the infrastructure footprint.

The Agency and EAO find that the effect of the loss of wetlands would be medium-term but reversible, medium in magnitude, and local in extent, and would occur continuously until replaced wetland habitats are fully functional. While the loss of wetlands would occur during construction, alteration of wetland habitat, including effects from changes to water quality or encroachment from invasive species could continue beyond the life of the project and would require active management into the far future.

Considering the above assessment, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to wetlands.

5.4.3 *RARE PLANTS*

The Agency and EAO acknowledge that rare plants are, by their nature, not resilient to changing conditions as their habitats are typically specialized and spatially limited. Given the history of disturbance in the local study area as a result of grazing, fire suppression and previous encroachment by human activities, the Agency and EAO recognize that available habitat for rare plants at the Ajax site is already compromised and that the loss of rare plants is a serious concern for SSN. In addition, because there is limited data on rare plants distribution and abundance in the region, the vulnerability of specific plant species or populations to Ajax effects is uncertain. The Agency and EAO are of the view that, given the limitations of existing rare plant data, a conservative approach to the effects assessment for rare plants is appropriate. While the loss of rare plants within the infrastructure footprint could potentially affect population viability in the region, the Agency and EAO also acknowledge that there is no evidence that rare plants and their microhabitats would not be available in other parts of the region.

Ajax would result in the direct loss of rare plant occurrences in the infrastructure footprint, and potential alteration of rare plant habitat in the infrastructure disturbance area. The Agency and EAO acknowledge that KAM has proposed mitigation measures to survey, and translocate rare plant occurrences, to progressively revegetate the Ajax site through operations, and ultimately to restore the site to a vegetated state during decommissioning and closure using native plant species. The Agency and EAO acknowledge that rare plants may not fully recover from salvage attempts and that translocation may not always be successful due to rare plants having very specific environmental, climatic, and geographic requirements. It is believed that rare plants would not re-colonize naturally. Additionally, although the Agency and EAO support KAM's commitment to rare plant research for the purposes of reclamation, there is presently no known source of rare plant seeds available for incorporation into the re-planting program.

The Agency and EAO note that KAM will either avoid or transplant the single identified occurrence of the *Species at Risk Act*-listed alkaline wing-nerved moss that occurs adjacent to the Ajax footprint. KAM also stated the occurrence could nevertheless be altered or lost. The agency have conservatively considered the loss of rare plant occurrences as irreversible, long-term effects, but acknowledge that as there are other occurrences of the alkaline wing-nerved moss in the regional study area, population effects associated with this loss could be reversible, depending on the success of KAM's translocation efforts.

The Agency and EAO understand that in addition to alkaline wing-nerved moss, KAM identified five blue-listed plant species and that one occurrence each would be lost in the infrastructure footprint. KAM also identified four red-listed plant species and one occurrence each would be lost in the infrastructure footprint and a fifth red-listed plant species, Sukdorf's broomrape, which would lose 10 occurrences in the infrastructure footprint. The Agency and EAO acknowledge KAM's commitment to working with provincial agencies and stakeholders to undertake regional rare plant surveys, but are of the view that KAM's focus on federal *Species at Risk Act*-listed plants in their monitoring and management plans was not sufficient, and that impacts to both provincially blue-listed and red-listed and federally SAR and COSEWIC listed rare plants should be addressed. As a result, the EAO is proposing an EA Certificate condition that would require that KAM conduct preconstruction surveys for all identified rare plants. EAO is also proposing an EA Certificate condition that would require KAM to develop and implement a Vegetation Management and Monitoring plan to avoid and mitigate impacts to rare plants.

The Agency and EAO find that the residual effects of habitat loss on rare plant species in the local study area would last into the far future and be a continuous effect, and consider that the anticipated permanent loss of a single occurrence of 5 blue-listed and 4 red-listed plant species, combined with the loss of 10 occurrences of a fifth red-listed plant in the local study area would be a medium magnitude effect. The Agency and EAO are of the view that the direct loss of rare plants including through alteration of their habitats, particularly those only identified within the mine footprint and with potential effects to adjacent areas from invasive species and other project effects would continuously and irreversibly affect regional populations of those plants. The Agency and

EAO acknowledge that the confidence in the effects assessment is low because of a lack of regional data for rare plant distribution and abundance, and therefore this assessment is conservative. The Agency and EAO agree with KAM that better data would likely identify more rare plant occurrences in the local and regional study areas, thus reducing the magnitude of the impact from the loss of those at the Ajax site.

Considering the above assessment, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to rare plants.

The Agency and EAO's characterization of the residual effects of Ajax on rare plants and their habitats, wetlands and grasslands, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

5.4.4 Cumulative Effects

The Agency and EAO are of the view that past and present projects and activities (urban development, construction of roads and highways, mining, forestry and cattle grazing), has contributed to cumulative effects on grasslands, wetlands, and rare plant species in the local and regional study areas. Contributions from these past and present sources were captured by KAM in its description of baseline conditions and have informed the identification and analysis of the residual effects discussed above.

The Agency and EAO consider that habitat loss and alteration resulting from reasonably foreseeable projects or activities in the region may produce residual effects that could interact with project-effects on grasslands, wetlands and rare plants. Notably the future development of the south areas of the City of Kamloops, and TMX would result in habitat loss and alteration that would add to habitat losses for grasslands, wetlands and rare plants.

The Agency and EAO acknowledge that the National Energy Board has imposed requirements on the approved TMX pipeline that include mitigation and offsetting for impacts to grasslands, avoidance and mitigation for loss of wetlands, and the implementation of rare plant monitoring, management and offsetting. Given these legal requirements, the Agency and EAO are of the opinion that cumulative effects of Ajax in combination with the TMX would be minor in magnitude.

The Agency and EAO acknowledge that the KAMPLAN provides for environmental protection of some areas adjacent to Ajax which are described as 'environmentally sensitive areas' but whose precise location and extents have not yet been determined by the City of Kamloops. The Agency and EAO are of the opinion that the cumulative effects on vegetation of Ajax in combination with the expansion of the City of Kamloops would be low in magnitude, because they would be unlikely to overlap temporally and because there would be protections in place for environmentally sensitive values in the regional study area.

5.4.5 Conclusion

Considering the above assessments, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to grasslands, wetlands or rare plants.

Taking into account the implementation of mitigation measures proposed by KAM, protection requirements for future identified activities, and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to for grasslands, wetlands or rare plants.

6 Wildlife

6.1 BACKGROUND

This section provides a summary of potential effects of Ajax on wildlife, the mitigation measures proposed by KAM to address those effects, a discussion of the key issues raised during the EA and how the issues were resolved. It also sets out the analysis and conclusions of the Agency and EAO regarding Ajax's potential adverse effects on wildlife.

Changes to vegetation and terrestrial ecosystems have the potential to affect habitat availability, quantity and quality for various wildlife species. For this reason, this section makes reference to Vegetation (section 5) and Surface Water (section 2). Due to the importance of wildlife to human health and Indigenous peoples, this section also contributes to Land and Resource Use (section 15), and Current Use of Lands and Resources for Traditional Purposes (section 18).

In addition to requirements under the respective federal and provincial EA legislation, the Agency must, under section 79 of the *Species at Risk Act*, identify Ajax's adverse effects on species on the *List of Wildlife Species at Risk* (Schedule 1 to the *Species at Risk Act*) and their critical habitats. If Ajax is carried out, preventative measures must be taken in a way that is consistent with applicable recovery strategy and action plans to avoid or lessen those effects and to monitor them. In addition, the Agency and EAO have examined the potential effects of Ajax on the species considered for designation by the Committee on the Status of Endangered Wildlife in Canada and those listed by the British Columbia Conservation Data Centre as either red- or blue-listed.

6.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

6.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

Ajax is located in an area that consists mainly of elongated, northwest-southeast trending, rolling grasslands with forested areas at higher slope elevations. There are no designated Wildlife Habitat Areas, parks or protected areas, or Old Growth Management Areas present in the local study area. Little undisturbed old-growth remains due to a history of logging, agriculture, forest fire and pine beetle, though old growth snags can still be found.

The local study area for wildlife covers 7,167 hectares and includes the Ajax footprint with a 50 m buffer used to calculate the potential direct effects (called the infrastructure disturbance area), plus a further 500 m buffer within which potential direct and indirect disturbance from Ajax would be expected to occur. The 158,415 hectare regional study area for wildlife includes portions of the South Kamloops Landscape Unit and Campbell Landscape Unit, including areas south of the Thompson River and west of Highway 97. The same study areas were used for vegetation.

KAM brought forward 43 species for further study in the EA because of regional concern, interest to Indigenous groups and the public, and their vulnerability to habitat or species loss. Wildlife species that hold special traditional importance for SSN but for which the population is considered widespread (e.g. moose) in the region, or species that have been extirpated from the area (e.g. elk), were not quantitatively assessed by KAM for potential effects from Ajax.

KAM conducted baseline studies to determine the presence and abundance of wildlife indicator species in the local study area (Table 11). Wildlife indicator species were selected to measure potential effects, based on at-risk species for the area, species of regional concern, and species likely to interact with the Project based upon their life history and geographical range, in accordance with the EISG/AIR.

Table 11: Wildlife Indicator Species Detected in the Local Study Area and Conservation Status

Indicator species (Common Name)	Detected in the local study area	BC conservation status	Committee on the Status of Endangered Wildlife in Canada status	Species at Risk Act status
Amphibians				
Columbia spotted frog	yes	yellow	not at risk	-
great basin spadefoot	yes	blue	threatened	threatened
northern pacific treefrog	yes	yellow	-	-
western toad	yes	blue	special concern	special concern
Migratory Birds				
barn swallow	yes	blue	threatened	-
common nighthawk	yes	yellow	threatened	threatened
great blue heron	yes	no status	-	-
Lewis' woodpecker	yes	red	threatened	threatened
long-billed curlew	unconfirmed observations	blue	special concern	special concern
olive-sided flycatcher	yes	blue	threatened	threatened
sandhill crane	yes	yellow	not at risk	-
Williamson's sapsucker	yes	blue	endangered	endangered
waterfowl	yes	-	-	-
Raptors				
bald eagle	yes	yellow	not at risk	-
great grey owl	yes	yellow	not at risk	-
peregrine falcon	yes	red	special concern	special concern
prairie falcon	unconfirmed observations	red	not at risk	-
rough-legged hawk	yes	blue	not at risk	-
short-eared owl	yes	blue	special concern	special concern
Swainson's hawk	yes	red	-	-
Non-Migratory Game Birds				
ruffed grouse	yes	yellow	-	-
sharp-tailed grouse	yes	blue	-	-
Mammals				
American badger	yes	red	endangered	endangered
moose	yes	yellow	-	-
mule deer	yes	yellow	-	-

Indicator species (Common Name)	Detected in the local study area	BC conservation status	Committee on the Status of Endangered Wildlife in Canada status	Species at Risk Act status
fringed myotis	yes	blue	data deficient	-
little brown myotis	yes	yellow	endangered	endangered
western small-footed myotis	yes	blue	-	-

The sections below summarize KAM's baseline information for the following groups of wildlife species: terrestrial invertebrates, amphibians, reptiles, migratory birds, raptors, non-migratory birds, and mammals, including bats.

6.2.1.1 *Terrestrial invertebrates*

KAM selected four butterfly species and one dragonfly as indicator species, because they are all blue-listed species and could have greater sensitivities to Ajax-related effects. All of the terrestrial invertebrate populations observed in the regional study area during field surveys were considered widespread and secure. KAM noted that monarch butterflies, which were selected for study in the EISG/AIR, were not found in the local study area and generally do not live in the region.

6.2.1.2 *Amphibians*

KAM selected two frog species and two toad species as indicator species. KAM's studies confirmed the presence of all indicator species within the local study area, including great basin spadefoot toad and western toad. The two frog species are considered to have widespread, secure populations. Nine mapped permanent wetlands in the local study area were confirmed as amphibian breeding habitat and a number of unmapped, ephemeral wetlands were also observed as amphibian breeding habitat. The great basin spadefoot toad is expected to be the most vulnerable of the amphibian indicator species.

6.2.1.3 *Reptiles*

KAM selected four provincially and federally listed snake species as indicator species: great basin gopher snake, western yellow-bellied racer, northern rubber boa and northern pacific rattlesnake. KAM reported that snakes return annually to particular subterranean features used as dens (hibernacula) in order to survive winter weather. Dens are usually communal and may be used by more than one species.

KAM's studies confirmed that the local study area is dominated by grasslands with no high value suitable living habitat for snakes. Mapping showed that two-thirds of the local study area provides moderate-rated living habitat, and only about 1% of the area provides moderate-value hibernating habitat. KAM identified one area of high suitability hibernating habitat for snakes, and confirmed four snake den sites in the local study area during field surveys. KAM stated that these dens would likely be used by all types of regional snakes. While none of the listed snakes were observed in the local study area during surveys, there was evidence of den use by garter snakes.

6.2.1.4 *Migratory Birds*

KAM selected nine migratory bird species (i.e. American bittern, barn swallow, common nighthawk, great blue heron, Lewis' woodpecker, long-billed curlew, olive-sided flycatcher, sandhill crane, and Williamson's sapsucker) as indicator species and waterfowl as an indicator group.

KAM's studies confirmed that varied habitats of the Thompson region, including arid grassland, shrub lands, open forests, cliffs, lakes, and riparian areas support a diverse group of migratory birds. KAM reported that some migratory birds are habitat specialists, requiring discrete habitats for successful nesting (e.g. wetlands or grasslands). These migratory birds are vulnerable to loss or degradation of wetlands and grasslands, particularly wetland-associated birds (e.g. waterfowl, great blue heron, and sandhill crane) which nest at wetland edges, and are also susceptible to water-borne contaminants.

Wetland-associated birds are the focus of subsequent sections of the Report, as they were expected to be the most vulnerable of the migratory bird indicator species, and management for these species would be generally effective for other migratory birds species found at Ajax.

6.2.1.5 *Raptors*

KAM considered nine raptor species as potential indicator species, including bald eagle, burrowing owl, flammulated owl, great gray owl, peregrine falcon, prairie falcon, rough-legged hawk, short-eared owl, and Swainson's hawk. These were selected as indicator species because of regional concern, interest to Indigenous groups and the public, and their vulnerability to habitat loss and loss of prey species.

KAM identified 4,733 hectares of grassland nesting and foraging habitat in the local study area (46,682 hectares in the regional study area) and 1,394 hectares of mature forest nesting habitat in the local study area that may be used by raptors. KAM confirmed that six raptor indicator species were present in the local study area, while a seventh (prairie falcon) was suspected. KAM stated that burrowing or flammulated owls are not expected to occur in the local study area because the available habitat is highly fragmented, and there is better habitat in the regional study area. KAM's field survey confirmed that burrowing owl has not recolonized any part of the local study area and there is a sparse amount of flammulated owl suitable habitat available in the local study area. KAM also stated that peregrine and prairie falcons are not expected to breed in the local study area as there is no suitable cliff nesting habitat for either species within the local study area. KAM's assessment subsequently focused on bald eagle, great gray owl, rough-legged hawk, short-eared owl, and Swainson's hawk.

6.2.1.6 *Non-Migratory Gamebirds*

KAM selected ruffed grouse and sharp-tailed grouse as indicator species for non-migratory gamebirds. Both species were selected because they are a traditionally harvested food source and culturally important to

Indigenous groups, and ruffed grouse is also hunted in the region. KAM's studies confirmed that ruffed grouse and sharp-tailed grouse use the local study area year-round.

During the breeding season, males gather at lekking[24] areas in open but secluded grassy habitats to display to females. Loss of lek habitat is a limiting factor for sharp-tailed grouse across the landscape and leks may be used for many years. Lekking sharp-tailed grouse and nesting hens are particularly susceptible to sensory disturbance. KAM identified four active and one inactive lek sites in the local study area; this compares to 11 active and three inactive lek sites in the regional study area. KAM also reported that the local study area contains a total of 3,667 hectares of growing and winter season habitat for sharp-tailed grouse.

6.2.1.7 *Mammals*

KAM selected nine species of mammals as indicator species: American badger, great basin pocket mouse, moose, mule deer, fringed myotis, spotted bat, Townsends' big-eared bat, western small-footed myotis, and little brown myotis.

KAM's studies confirmed the presence of American badger in the local study area, including 31 badger dig sites in the regional study area. Based on information provided by ECCC, there are 5,347 hectares of suitable habitat in the local study area and 56,585 hectares in the regional study area. American badger is vulnerable to Ajax's effects and has habitat requirements unique to grasslands.

Mapping studies identified that there are 1,394 hectares of primarily mature forest bat habitat in the local study area and 78,474 hectares in the regional study area. Of the bat indicator species, fringed myotis, little brown myotis, and western small-footed myotis were detected in the local study area.

KAM stated that given the limited sign of moose identified during field studies, limited suitable habitat, and the absence of critical moose winter range, it is likely that moose pass through but do not reside in the local study area. Moose was not assessed further. Mule deer can be found throughout the region and deer signs were apparent during most transect surveys. Approximately 900 hectares of draft or established critical deer winter range were identified in the local study area, of approximately 40,000 hectares in the regional study area.

6.2.2 KAM EFFECTS TO WILDLIFE AND MITIGATION MEASURES

The following section summarizes KAM's assessment of the potential effects and mitigation measures for wildlife valued components in general, and additional effects and mitigations specific to particular species in the assessment. KAM committed to a suite of mitigation measures, applicable to all wildlife valued components, to avoid, minimize and/or offset the impacts of Ajax. The key potential effects and mitigation measures are summarized below, and are further detailed in KAM's draft Wildlife Management and Monitoring plan (dated February 17, 2017).

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[24] A lek is a communal area where two or more males of a species perform courtship displays to attract mates.

6.2.2.1 *Habitat Loss and Alteration*

KAM indicated there would be loss of wildlife habitat within the footprint due to vegetation clearing, wetlands removal, and infrastructure construction. This includes the direct loss of 1,002 hectares of grasslands, 34 hectares of rock outcrops, 39 hectares of wetlands, and 309 hectares of mature forest. KAM's mitigation measures for habitat loss included:

- Avoiding sensitive sites (e.g., wetlands) where possible and practical;
- Restoring/reclaiming grassland and open forest in the mine footprint, at the end of operations;
- Implementing a wetland offsetting program; and
- Implementing a grasslands enhancement and restoration program.

KAM stated that wildlife habitat within the infrastructure disturbance area could be functionally compromised during construction or operations, as a result of increases in invasive species, fugitive dust deposition, and changes in drainage and water quantity in Peterson Creek downstream of the mine site, or along linear features (powerline and water pipeline corridors). KAM's mitigation measures for habitat alteration included:

- Implementing an Invasive Plant Management Plan that includes controlling invasive species by revegetating disturbed areas with appropriate native seed mixes, inspecting vehicles for invasive species, washing vehicles to remove invasive species, and treating/removing invasive species;
- Maintaining water quality by implementing a Surface and Groundwater Quality Monitoring and Management program that includes regular surface water quality monitoring in the background and receiving environments, and in the mine site facility reservoirs;
- Maintaining stream flow in Peterson Creek by implementing a Water Management and Hydrometric Monitoring Plan; and
- Using best management practices to suppress dust throughout Ajax (on site and access roads), and implement the Air Quality Monitoring and Dust Control Plan.

6.2.2.2 *Sensory Disturbance*

KAM stated that sensory disturbance from Ajax-related activities could cause individuals to avoid habitats due to noise and human presence that would otherwise be suitable, or to be drawn to unsuitable habitats in the case of lighting at Ajax. KAM stated that wildlife may habituate to regular noise up to 108 decibels. Impulse blasting noise and noise above 108 decibels can elicit behavioural responses such as effects on reproductive success, foraging behaviour, displacement from dens or nests, and flushing (flight) behaviour. KAM's mitigation measures for sensory disturbance included:

- Using best management practices to mitigate sensory disturbance by limiting noise at the source (e.g. use of muffled equipment);
- Limiting impulse blasting to daytime and avoiding simultaneous blasting;
- Avoiding construction and blasting activities during sensitive periods;
- Reducing traffic speeds and shuttling mine personnel to minimize noise;
- Using low sodium lamps, ultraviolet filters and directional lighting to minimize stray light; and

- Directing any illumination occurring outside Ajax infrastructure away from suitable (grassland, wetland) habitat, particularly during migration periods (March/April and late summer or fall).

6.2.2.3 *Direct and Indirect Mortality*

KAM stated that direct mortality could result from various activities including: removal of a habitat feature while it is occupied (e.g. young unable to leave a nest or burrow), wildlife-vehicle / machinery collisions, and interactions with anthropogenic structures (e.g. bird collisions with wires). Indirect mortality could result from exposure to toxic chemicals in water bodies, such as the tailings storage facility. Additionally, attraction to the presence of sewage infrastructure and disposal, non-contact and contact water could result in reduced growth or reproductive success. KAM's mitigation measures for direct and indirect mortality, including attractants and chemical hazards, included:

- Confirming the absence or presence of active wildlife activities (e.g. nests, hibernacula, breeding areas) in areas where work is to occur, using a registered professional biologist (qualified professional);
- Flagging sensitive areas and avoiding vegetation clearing during breeding / rearing periods (February to October, depending on species);
- Conducting pre-clearing surveys to verify animal presence and identify sensitive habitat;
- Implementing traffic management to reduce speed limits and ensure vehicles yield to wildlife;
- Modifying habitat adjacent to roads to reduce wildlife suitability, improve driver visibility for wildlife species, and reduce mortality;
- Implementing the Spill Contingency Plan to prevent and mitigate the effects of chemical spills; and
- Reducing and removing attractants by implementing a Solid Waste Management Plan, Hazardous Waste Management, Surface Water Quality Management and Monitoring Plan.

Key additional species-specific mitigation measures are listed in KAM's Wildlife Mitigation and Monitoring Plan (February 17, 2017).

6.2.3 KAM'S ASSESSMENT OF RESIDUAL EFFECTS

6.2.3.1 *Terrestrial Invertebrates*

KAM concluded that because the terrestrial invertebrates identified in the regional study area during field surveys were considered widespread and secure, there would be no residual effects to terrestrial invertebrate habitat or population health and abundance.

6.2.3.2 *Amphibians*

KAM concluded that, after implementation of mitigation measures, Ajax would result in residual effects to amphibian habitat, and population health and abundance due to habitat loss, mortality and exposure to chemical hazards.

KAM reported that the loss of suitable amphibian breeding habitat would be unavoidable from vegetation clearing and ground disturbance activities, and would have an effect on amphibian species present in the local study area. KAM would conduct pre-construction surveys to confirm wetland use by great basin spadefoot and western toad, and integrate amphibian habitat into wetland compensation sites. Although these replacement wetlands will reduce the effect on amphibians in the long-term, a residual effect would be present for the life of

Ajax. KAM reported that Ajax would result in a loss or alteration (including sensory disturbance) of 50% of great basin spadefoot breeding habitat in the infrastructure footprint plus an additional 25% alteration in the infrastructure disturbance area. In total, there would be a loss or alteration (including sensory disturbance) of up to 74% of breeding habitat in the local study area, or up to 23% in the regional study area.

Clearing and grubbing, and earthworks are expected to result in direct mortality of amphibians inhabiting the area. Although KAM would translocate individuals and install culverts ("toad tunnels") at known migration areas to reduce the effect, some direct mortality would occur.

KAM reported that chemical hazards would have adverse effects on amphibians in their aquatic life stages (e.g. embryos, tadpoles) as these are the elements that will be above aquatic habitat guidelines for Peterson and Humphrey Creeks. However, this is a conservative approach because western great basin spadefoot and western toad do not typically reproduce in flowing water (i.e. creeks). KAM proposed to reduce and remove attractants that would decrease amphibian reproduction, growth and mortality and create artificial diversion pools to attract amphibians away from the mine site infrastructure. KAM noted that elevated concentrations of many parameters are predicted to occur during December and January, when surface flows are typically low to non-existent in Peterson and Humphrey Creeks and the early life stages of aquatic life are typically not present.

6.2.3.3 *Reptiles*

KAM concluded that, taking into account the implementation of mitigation measures, there would be no residual effects of Ajax to reptile habitat or population health and abundance. KAM would translocate snakes to appropriate habitat, where avoidance is not possible, and construct artificial snake dens, reptile habitat, and roadside berms or culverts/snake crossings.

6.2.3.4 *Migratory Birds*

KAM concluded that, after implementation of mitigation measures, Ajax would result in residual effects to migratory bird (waterfowl, sandhill cranes, great blue heron) habitat, and population health and abundance due to decrease in habitat availability and suitability, and an increase in exposure to chemical hazards of selenium, molybdenum, and other elements.

KAM stated that migratory bird species who highly utilize wetland and grassland habitat would be affected by the loss of loss and alteration of wetland habitat. KAM proposed to create shrub/grassland habitat and artificial nests on mine rock areas to provide feeding, nesting and security habitat, create 28.7 hectares of wetlands and water features on KAM-owned lands for water associated birds, and provide nesting and foraging habitat, and nest boxes for cavity-nesting species (waterfowl). KAM acknowledged that reclamation and revegetation of the Ajax footprint would not fully mitigate for the loss of migratory bird habitat. KAM stated that waterfowl, great blue heron, and sandhill crane have a low resilience to loss of wetlands. KAM predicted that migratory birds could experience sensory disturbance due to blasting noise close to Jacko Lake, and that migratory birds could become disoriented due to Ajax lighting at night. To address these effects, KAM proposed to schedule blasting activities to avoid sensitive periods for wildlife, and use low sodium lamps, ultraviolet filters and directional lighting to minimize stray light.

KAM concluded that exposure to contact water in the tailings storage facility may lead to adverse chemical hazard effects to waterfowl and wetland associated indicator species (i.e. sandhill crane and great blue heron).

KAM predicted the potential exposure would likely to be infrequent, and the baseline levels of molybdenum and selenium currently exceed water quality guidelines in the Ajax area. KAM stated that the risk of exposure would be continuous over the long term, but localized to those contaminated waterbodies. KAM reported that the ecological context is also considered low since waterfowl species are common and Jacko Lake, which currently supports the majority of the waterfowl population in the local study area, would remain functional.

6.2.3.5 *Raptors*

KAM concluded that, after implementation of mitigation measures, Ajax would result in residual effects to raptor habitat, and population health and abundance due to reduced habitat, and potential nest abandonment because of sensory disturbance.

KAM predicted that the loss of habitat, including suitable raptor nesting habitat and prey species habitat, would impact some raptor species more than others, specifically species who have more specialized life requisites. The majority of the habitat lost would be grasslands, followed by mature forest. A reduction in suitable prey habitat (grasslands) would likely result in a reduction of prey, reducing the ability of some raptor species to meet its energy requirements. KAM proposed to avoid sensitive nesting sites (e.g. large diameter trees and snags), establish species-specific buffers around raptor nests if encountered, relocate known active nests that cannot be avoided, avoiding blasting during sensitive periods, and restore grasslands in the Ajax area. KAM reported that the removal of known Swainson's hawk nests may not be avoidable, but creation of nesting structures was included as mitigation in the Wildlife Management and Monitoring Plan.

KAM predicted that sensory disturbance on nesting individuals from Ajax activities (e.g. drilling, blasting, and rock crushing) may be mitigated by limiting specific activities to specific time periods to avoid critical periods, and establishing buffers around active nests if work must occur during sensitive periods. KAM stated that limiting all Ajax noise to avoid wide ranging sensitive times of year would not be practical, and there may be residual effects to reproducing raptors.

6.2.3.6 *Non-Migratory Game Birds*

KAM concluded that, after implementation of mitigation measures, Ajax would result in residual effects to non-migratory game bird habitat, and population health and abundance due to loss of suitable habitat and known lek sites, and decreased use or abandonment of lek sites and nests due to sensory disturbance.

KAM concluded that the loss of sharp-tailed grouse habitat, as well as the potential removal of known lek locations, will not be completely mitigated. KAM reported that habitat loss will occur for sharp-tailed grouse, with the potential removal of greater than 50% of suitable habitat in the local study area. Sharp-tailed grouse are known to be sensitive at lekking locations, dependent on grasslands to meet various life requisites, and have a low resiliency to habitat loss. KAM proposed to restore and reclaim grassland and open forest, including creating two artificial lek sites for every known lek removed or abandoned, and ensure that initial stockpile development occurs outside of the lekking season. KAM also proposed adaptive management, based on monitoring of potentially disturbed leks, artificial leks, as well as leks outside of the local study area to determine how grouse react to Ajax disturbance. KAM would restore sharp-tailed grouse habitat through reclamation and revegetation processes during decommissioning and closure.

KAM reported that drilling and blasting noise, combined with road noise and other Ajax activities, may deter sharp-tailed grouse from using leks that occur within the local study area. Although KAM would implement practices to limit noise during specific times of day and sensitive periods (e.g. lekking hours from sunrise to about 10:00 am), KAM said there could be a residual effect to courting sharp-tailed grouse, and nesting sharp-tailed and ruffed grouse. Hens may abandon their nests if disturbed by noise and males may avoid lek sites during critical mating periods. If nests are abandoned during the breeding season, grouse eggs and nestling may not survive.

6.2.3.7 *Mammals*

KAM concluded that, after implementation of mitigation measures, Ajax would result in residual effects to American badger, bats, and mule deer.

6.2.3.8 *American Badger*

KAM concluded that, after implementation of mitigation measures, Ajax would result in residual effects to American badger habitat, and population health and abundance due to habitat loss and alteration, sensory disturbance and direct mortality.

KAM stated that the loss and alteration of suitable badger habitat cannot be avoided. Over the long-term, some habitat may be restored through reclamation and revegetation processes (during operation, closure and post-closure); however, this will not necessarily equate to suitable badger habitat as soils will not have the same friability[25] as pre-Ajax. KAM reported that habitat loss or alteration is expected to have the greatest impact on badgers, with approximately 1,657 to 2,923 hectares (31-55%) loss or alteration of suitable habitat in the local study area being affected by Ajax, which represents 3-5% of suitable habitat for badgers in the regional study area. Up to 19 of the 23 (73%) badger dig sites in the local study area are also predicted to be lost. A loss of prey species in grasslands and loss of dig sites could potentially affect the American badger's reproductive success and reduce protection from predators. KAM proposed pre-construction surveys to identify suitable American badger habitat (grasslands) on KAM-owned lands that would be enhanced to provide better forage opportunities and would be protected by fencing to prevent livestock incursions. KAM stated that enhancing KAM-owned lands to improve badger habitat forage opportunities, would reduce residual effects to badgers.

KAM concluded that sensory disturbance is anticipated for badgers, as a result of drilling and blasting noise that may cause an increase in stress for denning individuals. Up to 1,290 hectares of badger habitat outside of the Ajax footprint may have increased sensory disturbance, and drilling and impulse blasting noise in the mine pit and equipment operation along mine roads could elicit behavioural responses in American badger. KAM stated that badgers are known to burrow into, and persist alongside railroad berms, indicating a high resiliency to sensory (noise) disturbance. KAM proposed fencing off grassland habitat on KAM-owned lands used by American badger to control livestock intrusion during birthing and rearing (March through August). KAM concluded that sensory disturbance of denning badgers is anticipated; however, the conditions are anticipated to vary from baseline only slightly (blasting to occur only once per day).

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[25] A friable soil has the tendency to crumble or easily fragment.

Increased vehicle traffic on and near the Ajax footprint, and displacement of badgers to areas closer to roads, could increase the risk of direct mortality from vehicular collisions. KAM proposed to reduce collisions through implementing speed limits and wildlife signage, modifying habitat near roads to decrease suitability for badgers and their prey, and minimizing the number of vehicles using site roads

KAM concluded that Ajax could impact badgers' ability to move between suitable habitats and may cause the animals to shift away from the disturbance. KAM reported that disruption of movement could result in increased energy expenditures and decreased reproductive success, resulting in a decrease in badger population size and persistence within an area where their habitat is already fragmented from past activities in the local study area. KAM proposed additional hair snagging efforts to help determine where individuals are located across the landscape, the composition of the badger population in the local study area, and monitor how they respond to the mine. KAM rated the potential effect of disruption to movement on badgers to be minor due to the amount of suitable habitat that would be fragmented by Ajax. KAM concluded that while disruption of movement may decrease use by badgers in the area, habitat loss is anticipated to have the greatest impact on the badger's ability to meet its life requisites.

6.2.3.9 *Bats*

KAM predicted that Ajax would result in residual effects to bats due to loss and alteration of suitable habitat, direct mortality from loss of roosts, and reduced growth and reproductive success due to ingestion of chemicals in mine-affected water.

KAM predicted a loss or alteration of 309 hectares (22%) of mature forest habitat preferred by bats for roosting in the infrastructure footprint, 592 ha (42%) in the local study area, and just 0.004 % in the regional study area. Bat hibernacula, if not detected, could be lost during construction. KAM proposed conducting pre-construction surveys to identify areas where clearing activities could be conducted outside of the breeding and rearing season, identifying and preserving little brown myotis maternity roosting sites, consulting with the relevant regulating body to develop and appropriate approach to mitigation, and installing bat roost and maternity boxes to provide roosting structures for tree roosting bats. KAM stated that maintaining foraging sites (wetlands and riparian areas) on KAM-owned lands, would reduce residual effects to bats.

KAM predicted that there could be an increase in chemical hazards to bats because of the presence of open contact water in the tailings storage facility. KAM stated that occasional ingestion of contact water may not cause negative effects in bats; however, long-term, repeated exposure has the potential to negatively impact bat populations in the area. KAM proposed introducing duckweed and laying nets over contaminated water bodies to interfere with smooth surfaces (e.g. tailings storage facility) to discourage bat use of contact water.

6.2.3.10 *Mule Deer*

KAM reported that Ajax would result in residual effects to deer habitat due to loss and alteration of suitable habitat.

Approximately 37,255 hectares of critical deer winter range and 35,912 hectares of draft deer winter range are available in the regional study area. KAM concluded that loss or alteration of

32.8-154.4 hectares (4-18%) of critical deer winter range and 90.7-234.4 hectares (10-26%) of draft deer winter range within the local study area may not be avoidable. Mule deer, which require forested areas for shelter, forage, and reproducing/rearing opportunities, can be found throughout the area. In British Columbia, mule deer is considered widespread, abundant, and secure.

6.2.4 CUMULATIVE ENVIRONMENTAL EFFECTS

KAM stated that past land use (e.g. forestry, agriculture and urban development) has substantially affected grasslands and forests and would continue to result in changes to wildlife habitat types, distribution and suitability. Present and future projects and activities that were considered in the cumulative effects assessment include: the New Afton Mine, TMX, industrial projects (e.g. Domtar Kamloops Pulp Mill), forestry, agriculture, ranching, tourism (e.g. golf courses), linear development (e.g. pipelines, highways, railways), and urban development (Aberdeen).

Ajax would result in residual effects to wildlife habitat, notably grasslands and wetlands which support the greatest number of wildlife species, and these effects have potential to act cumulatively with agriculture, ranching and potential future urban development (Aberdeen). KAM reported that habitat loss associated with past, present and future projects and activities could not be quantified for wildlife valued components, and that in the majority of cases, no information was available on total habitat loss. Consequently, KAM conducted a qualitative analysis to determine potential interactions based on professional judgement, location of these projects and activities, and the sensitivity of wildlife indicators to habitat loss. KAM stated that there are large patches of grassland located southeast of Ajax (in the regional study area) that have not been heavily disturbed, and reported that habitat loss and alteration from current and reasonably foreseeable projects and activities identified for this area would be minor in nature.

KAM reported that the residual effects of loss or alteration of habitat (great basin spadefoot, western toad, wetland-associated migratory birds, rough-legged hawk, great gray owl, short-eared owl, Swainson's hawk, sharp-tailed grouse, badgers and bats) are expected to act cumulatively with New Afton Mine, TMX, forestry, agriculture, ranching, City of Kamloops expansion, and transportation projects. KAM stated that the cumulative reduction in habitat may impact these species locally and regionally. Recognizing that Ajax's contribution to cumulative species at risk habitat losses cannot be fully mitigated, KAM acknowledged that further mitigation measures and adaptive management may be required which would be identified through implementing the Wildlife Management and Monitoring Plan.

Although sensory disturbance of wildlife due to blasting would be a residual effect, KAM predicted there would be no interaction with other noise sources in the vicinity of Ajax. KAM stated that sensory disturbance was not anticipated to be compounded by other projects or activities in the region as there are no other known high intensity, short duration noise (blasting) events expected to occur. KAM noted that Highway 5A would have the potential to interact with Ajax to further disrupt movement of wildlife between suitable habitats.

KAM reported that the residual effect of direct mortality of amphibians has the potential to act cumulatively with forestry activities and City of Kamloops expansion and growth, and to a lesser extent, TMX, agriculture, ranching, recreation and transportation, resulting in a reduction in the regional population.

KAM reported that residual effects of Ajax due to exposure of bats (e.g. little brown myotis) and waterfowl to chemical hazards in the tailings storage facility have the potential to act cumulatively with the effects of chemical hazards in the tailings storage facility at the New Afton Mine, causing effects on bats over time (e.g. failed reproduction or indirect mortality). However, KAM stated that exposure would be limited and the cumulative effects are predicted to subside over time.

6.2.5 MONITORING AND FOLLOW-UP

In order to address uncertainty in respect of the effectiveness of the proposed mitigation measures for certain wildlife valued components, KAM proposed the following components in a monitoring and follow-up program for Ajax:

- Undertake pre-construction surveys in areas where wildlife and species at risk have been previously identified and along linear corridors to pinpoint sensitive wildlife features;
- Implement the Wildlife Management and Monitoring program, which includes verifying the predictions of residual effects, monitoring the effectiveness of the mitigation measures for wildlife and determining whether further mitigation and adaptive management may be required;
- Conduct a follow-up program for the grassland restoration and the wetlands compensation program, replacement lek sites, nesting boxes, and bat roosting boxes to verify the success of these measures and determine if additional adaptive measures would be required;
- Monitor the use of the tailings storage facility by migratory birds and bats to verify the effectiveness of the mitigation measures and the need for adaptive management measures;
- Monitor metal content in vegetation as part of the Human Health and Ecological Risk Assessment to predict and adaptively manage potential effects to wildlife and livestock; and
- Monitor water quality within wetland compensation areas, particularly shallow, open water habitats to determine suitability for wildlife.

6.3 DISCUSSION OF ISSUES

During the EIS/Application review phase, members of the working group and the public raised concerns related to the potential effects of Ajax on wildlife. This section provides a summary of the key issues raised and KAM's responses.

6.3.1 BASELINE SURVEY METHODS AND BASELINE CONDITIONS

ECCC, MFLNR, SSN, MNBC, and the City of Kamloops expressed a number of concerns related to baseline conditions, including: insufficient baseline survey work was completed for wildlife, wildlife surveys were too limited, lack of surveys in the powerline and waterline corridors, inappropriate methodology applied to the terrestrial ecosystem mapping of the Ajax area for biophysical values, and failure to collect critical information (e.g. migration timing, bat roosts and hibernacula, diurnal raptors, inter-annual variation). SSN and MNBC noted that irregular detection and sparse distribution of species at risk was a function of species status (i.e. rare) and not evidence of absence in the local study area. Further, SSN and the City of Kamloops commented that effects on wildlife cannot be effectively undertaken by just monitoring listed species, as rare species are scarce, leading to small sample sizes, monitoring issues, and lack of statistical data. The uncertainties resulting from the baseline surveys were viewed as undermining confidence in the baseline results presented in the EIS/Application.

KAM responded that even though a species may not have been observed during field surveys, where habitat mapping was conducted a conservative approach had been taken and it was assumed that the habitat was being used and therefore would require protective measures. KAM responded that surveys were conducted during the breeding and migratory bird periods from 2007 to 2014 using a variety of standard survey techniques supported by scientific literature. KAM conducted additional mapping of wetlands and waterbodies in the linear corridors and identified additional wetlands that would be lost (3.5 hectares) or altered (8.4 hectares). KAM provided an updated Wildlife Management and Monitoring Plan that included commitments for pre-construction surveys along the powerline corridor to identify wildlife habitat that would be used to target sensitive habitat (e.g. maternity roosts and hibernacula) and sensitive timing (e.g. breeding/fledging) at the mine site, and would add to general baseline data. KAM would develop and implement, at or before construction activities, a Wetland Compensation Plan, and would monitor the riparian areas along Peterson Creek to ensure that they still contain wetted portions in the spring for migratory bird habitat.

SSN stated that the Ponderosa pine and wetlands in the Ajax area represent 45% of all the breeding sites for western screech owl in BC, and expressed concern about the baseline information on impacts. KAM responded that western screech-owl is unlikely to occur in the Ajax area due to their preference for habitat elevations below 700 m (and the areas in the local study area are above 800 m). However, KAM stated they would conduct pre-construction surveys to map identified draft critical habitat potential without an elevation constraint. KAM would identify potential nest box sites within grassland enhancement and restoration areas.

MFLNR and the City of Kamloops expressed concern about the lack of information on ephemeral wetlands and lake margins, stating that this information was necessary to understand the impacts of wetland loss for critical amphibian life stages, and questioned the accuracy of the confirmed and observed amphibian habitat. KAM conducted additional analysis (as reflected in section 6.2.3) to quantify the loss of amphibian breeding habitat, and modified their impact assessment for great basin spadefoot estimating up to 50% of available habitat in the local study area would be removed or altered.

The City of Kamloops indicated that the lack of telemetry used to identify potential bat hibernaculum and roosting habitat leaves uncertainty about the presence of bats, and vulnerability to direct mortality during construction. KAM committed to refine their modelling of suitable hibernacula habitat, and based on the results of this mapping and in consultation with a bat biologist, conduct pre-clearing surveys of potential hibernaculum during the winter bat hibernation period (October 1 to May 31). If bats are present or there is evidence of their presence, the hibernaculum would not be destroyed during the hibernation period.

6.3.2 KAM's Environmental Assessment Methods, Monitoring Plans and Conclusions

SSN stated that KAM did not set out biologically important effects or thresholds for monitoring beyond which the effects would be deemed unacceptable. During the EA, KAM revised the Wildlife Management and Monitoring Plan to require pre-construction surveys for gathering and verifying additional baseline information for species at risk, migratory birds, and wetland function within the local study area. KAM also indicated that specific monitoring metrics to identify effects to wildlife would be developed during permitting.

MFLNR, the City of Kamloops, SSN, and the public raised concerns about effects of noise and vibration on birds, nesting birds and egg development, and noted that KAM used the human annoyance threshold which is not applicable for birds. The public expressed concern that the noise from blasting could affect the migration of sandhill cranes due to their alighting or resting in Separation Lake, located 5 km from the mine boundary, noting that this population of sandhill cranes represents roughly 1.5% of the Canadian population during their migration. KAM responded that blasting will be limited to outside the daily sensitive period (i.e. no blasting from dawn until four hours after dawn). KAM cited studies that indicate noise does not appear to elicit flushing responses or effects on breeding at distances within those assessed for Ajax.

MFLNR, ECCC, the City of Kamloops, and SSN requested clarification of the methods KAM used to determine their significance assessment for wildlife valued components. In particular, working group members were concerned that the same metrics were used for all valued components regardless of their individual contexts (e.g. rarity, population trends), and regardless of the number of multiple impacts to that valued component. MFLNR, the City of Kamloops, and SSN disagreed with KAM's assessment of impacts to at-risk wildlife species, stating that the magnitude thresholds used did not consider any context such as rarity and populations declines. SSN maintained disagreement with the results of the studies presented by KAM and their conclusions.

SSN expressed concern with the adequacy of KAM's assessment of sensory disturbance to denning badgers, given that 15 of the 26 badger dig sites identified are within the 108 decibel blast radius. SSN questioned KAM's conclusion that potential noise and vibration disturbance to denning badgers would be minor. KAM stated they would use the hair snagging as a monitoring methodology to determine where individuals are located across the landscape, the composition of the badger population in the local study area, and to assess how badgers respond to the mine during construction and operation. SSN expressed concern about wildlife being affected by noise and vibration, access to adequate food, and a reduction in the intergenerational transfer of knowledge over the course of a generation which will not have access to an undisturbed environment where they can learn the interrelationship of all aspects of the lands.

MFLNR and ECCC maintain that there are outstanding data gaps and there is insufficient baseline data, which has led to uncertainty in assessing the adequacy of mitigation measures and reduced confidence to assess potential effects. The City of Kamloops identified concerns with sampling protocols, and stated that the survey results are insufficient to properly characterize baseline conditions and the effects assessment.

The Agency and EAO understand that the supplemental information provided by KAM during the EA process did not satisfy the concerns raised by MFLNR, ECCC and the City of Kamloops. To fill the data gaps and reduce uncertainty, EAO has proposed a series of EA Certificate conditions to be developed in consultation with MFLNR, MOE, ECCC, and Indigenous groups. KAM would be required to conduct more detailed field surveys prior to construction and to develop mitigation and monitoring plans. Rigorous monitoring during all phases of Ajax will be important to verify predictions and enable pre-determined adaptive management actions.

6.3.3 MULTIPLE EFFECTS TO WILDLIFE VALUED COMPONENTS

SSN, the City of Kamloops, and MFLNR raised concerns that the methods for the assessment of potential impacts to wildlife did not capture the interaction of effects from a variety of stressors. MFLNR requested a multiple effects analysis of impacts to wildlife valued components, to show the additive effect from all sources of stress including habitat removal or alteration, sensory disturbance, disruption of movement, direct and indirect mortality, wildlife attractants, and chemical hazards. In particular, working group members were concerned about the effects of noise on wildlife's ability to complete required stages of their life history such as migration, pairing success, bat foraging, reptile hibernation, and mammal denning. KAM provided supplementary assessment information for combined multiple effects. This included more conservative assumptions, such as considering habitat found within the 108 decibel contour as being effectively lost, and the incorporation of additional habitat alteration due to invasive plants species outside of the infrastructure disturbance area. KAM presented the results which effectively increased the magnitude of the effect, but stated this reassessment did not increase effects beyond what KAM considered the threshold for significance.

MFLNR expressed concerns about the lack of a cumulative and additive effects assessment for badgers in the EIS/Application and requested that KAM undertake an assessment which included direct habitat loss, habitat avoidance because of noise, and energetic costs associated with a loss or alteration to available habitat in the local study area. KAM re-assessed the impact to badgers and determined that Ajax would result in a 64% to 73% loss or alteration and sensory disturbance (direct and indirect) of suitable badger habitat in the local study area, and 6% to 7% in the regional study area, which was an increase from the estimate provided in the EIS/Application.

6.3.4 EFFECTIVENESS OF MITIGATION MEASURES

ECCC, MFLNR, and SSN expressed concern regarding KAM's mitigation measures for amphibians, snakes, and bat maternity roosts and hibernacula in the local study area. KAM responded that standing water would be monitored, all age classes of amphibians would be translocated, exclusion fencing for amphibians would be installed as appropriate, and the Wetland Offsetting Plan would mitigate for effects to loss of amphibian breeding habitat. KAM also responded that rock crevice hibernacula were identified in the local study area outside the area that would be affected by Ajax. Further, KAM indicated that bat roosting boxes would be installed near foraging sites. KAM also revised their Wildlife Management and Monitoring Plan to include pre-construction surveys to confirm bat hibernacula and roosting sites for avoidance during construction or for identifying compensation sites.

MFLNR and the City of Kamloops raised concerns with the effectiveness of mitigation planned to relocate snakes, given that some snake species have very high fidelity to their hibernacula, breeding grounds, gestation sites, and foraging areas. KAM noted that alternative mitigation measures were not provided to KAM by MFLNR or the City of Kamloops. ECCC, City of Kamloops, SSN, and MFLNR requested further studies to verify if there are snake hibernacula which may be within the Ajax footprint, and confirm the location of movement corridors for snakes including at-risk species. In response, KAM updated the Wildlife Management and Monitoring Plan to include supplemental pre-construction surveys and, based on the results of those surveys, to undertake further measures to protect hibernating snakes and to safely move snakes out of the Ajax area.

Working group members questioned the implementation and effectiveness of key mitigation measures, such as the use of 'diversion pools' during construction and operations to attract amphibians away from the mining activity. KAM responded that diversion pools would be constructed outside of Ajax's zone of influence, and on KAM-owned land. At least two pools will be created in relative proximity to where confirmed amphibian breeding habitat is anticipated to be lost to the Ajax footprint, but that the number, location and size of pools would be based on results of the functional wetland assessment surveys, and would aim to offset impacts to amphibians.

ECCC, SSN, MFLNR, and the public expressed concern regarding the loss of migratory bird habitat, particularly water birds (loss of wetlands) and songbirds (loss of grasslands) and that construction during the nesting period for migratory birds would present a potentially high risk of destruction, disturbance, or harm to migratory birds, their eggs and nests. KAM responded that vegetation clearing would be scheduled outside of sensitive periods

(April 1 to August 15), wherever possible. KAM would conduct surveys if work proceeded during the sensitive period and KAM would protect active nest sites with a minimum 30 m buffer, using species-specific guidance documents from ECCC.

ECCC provided KAM draft critical habitat for Lewis' woodpecker and western screech-owl subspecies *macfarlanei* during the review period. ECCC notes that the waterline and powerline, and potentially other Ajax infrastructure, are likely to overlap with this habitat. ECCC considered that effects on critical habitat could jeopardize the survival and recovery of these species. In response to this new information, KAM updated the assessment information for Lewis' woodpecker as additional habitat was confirmed present in several patches within the linear corridor. KAM proposes to avoid proposed critical habitat identified in the Recovery Strategy for the Lewis's woodpecker (*Melanerpes lewis*) in Canada [2016], by conducting pre-construction surveys along both linear corridors to identify and avoid sensitive habitat features, and installing nest boxes, if needed.

The City of Kamloops and MFLNR expressed concern about the effectiveness of KAM's proposal to create artificial lek sites to offset the anticipated loss or abandonment of leks due to Ajax. KAM responded that they propose to replace lost or abandoned leks at a 2:1 ratio, noting that research has indicated that sharp-tailed grouse will use replacement leks if they occur in fairly close proximity to existing leks. KAM responded that the Wildlife Management and Monitoring Plan includes monitoring and buffering of leks anticipated to be indirectly impacted, monitoring of all known and replacement leks on an annual basis and adaptive management of any sites that are subsequently abandoned as a result of disturbance from Ajax.

SSN expressed concern that the Jacko Lake area provides a valuable contribution to the warm level grasslands of Interior BC, providing important movement corridors for sharp-tailed grouse and other grassland-dependent species. SSN stated that a large portion of the area immediately north of Jacko Lake provides ideal habitat conditions for the establishment of sharp-tailed grouse leks and there are also identified areas of wintering habitat. SSN raised deep concern about the loss of this area, loss of two leks, and disturbance in the movement corridors. SSN noted that knowledge keepers have also identified that grouse in the regional study area have been in evident decline over the last 10 years indicating that further additional impacts would have exponential effect on this regional and local trend of population decline. SSN expressed extremely low confidence in the mitigation strategies, in particular, artificial lek creation.

MFLNR stated that there is a high level of uncertainty about the likelihood of shrub/grassland habitat that is reclaimed on mine rock areas providing suitable badger habitat, as soils will not have the same friability and therefore may not allow burrowing for badgers. MFLNR requested that KAM provide additional mitigation measures and an offset/compensation plan to address the loss and alteration of badger habitat. KAM committed to consider, where possible, additional soil design criteria for reclaimed areas so that friability is adequate for badger habitat, such as reclaimed engineered soil covers on mine facilities and compacted surfaces throughout the mine site. MFLNR noted that road mortality is a hazard for badgers and requested that a road density assessment be completed. KAM considered a road density assessment unnecessary, but added additional mitigations to KAM's Transportation Management Plan and the Wildlife Management and Monitoring Plan to further minimize vehicle-badger collisions. KAM stated that they would install culverts under roads to facilitate amphibian movement between Jacko Lake and Inks Lake, which will also provide alternative road crossing locations for badgers. To address the request for offsetting, KAM provided a Grasslands Restoration and Enhancement Program that includes monitoring and mitigations to improve badger habitat. That program is discussed further in Vegetation (section 5).

6.3.5 CHEMICAL EXPOSURE AND CONTAMINATION

SSN, MFLNR, the City of Kamloops, and the public raised concerns about migratory birds, amphibians and bats being exposed to chemical hazards in the tailings storage facility and mine rock storage facility. The City of Kamloops, Lower Nicola Indian Band, and the public noted that the modelling of potentially hazardous substances, such as mercury, molybdenum, selenium, sulphate, chloride, and fluoride, found that some wildlife water quality guidelines were exceeded at all locations throughout the mine site. Lower Nicola expressed concern that areas reclaimed for wildlife use may pose a risk for wildlife, particularly due to exposure to molybdenum and selenium. KAM responded that, based on the ecological risk assessment, the level of contaminants was below provincial and Canadian Council of Ministers of the Environment guideline thresholds. KAM stated that monitoring of molybdenum concentrations in soil, surface water and plant tissue will be included as part of the on-going monitoring program over the life of Ajax. Should monitoring results indicate a change in water quality or soil and plant quality that differs from the predictions presented in the human and ecological health risk assessment, potential wildlife effects would be mitigated through adaptive management.

MFLNR recommended that KAM proactively manage any mine site water known to contain elements toxic to bats, as they are likely to use all available drinking water, rather than applying identified mitigation measures after ongoing monitoring as stated in the EIS/Application. In response, KAM committed to actively dissuade bats from identifying contaminated waterbodies by covering ponds and flat surfaces with duckweed or other foreign objects, immediately following construction. KAM also stated they would conduct ongoing monitoring and adaptive management of use of the tailings storage facility by migratory birds and bats and would develop further mitigation and monitoring details during the *Mines Act* permitting process.

MFLNR expressed concern about the impacts of dustfall on terrestrial and aquatic life, and recommended that if the threshold of $1.7 mg/dm^2$/day dustfall be exceeded, a dust mitigation contingency plan be implemented. KAM responded by recalculating the risk assessment for wildlife in the vicinity of Jacko Lake and Peterson Creek (the areas assumed to have the greatest exposure) based on the various dust suppression scenarios and found that exposure to Ajax-related contaminants in soil and water represented a negligible ecological risk to wildlife. KAM stated they would develop a detailed air quality monitoring and management plan as required by the *Environmental Management Act* and the *Mines Act* as part of the permit applications to construct and operate the mine. KAM expects that this plan will include contingencies is agreed to thresholds are approached and/or exceeded. KAM stated that FLRNO would have an opportunity to review the plan and provide recommendations, as part of the permitting process.

HC expressed concern that the modelling of COPCs could underestimate bioaccumulation and contamination of country foods in non-migratory game, such as sharp-tailed grouse. KAM responded that, in their view, they have taken a conservative approach by modelling and assessing metal levels in the tissues of small mammals such as field mice, voles and/or shrews.

6.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

After considering relevant mitigation measures proposed by KAM, information received during the EA, and mitigation measures to be implemented with respect to wildlife, the Agency and EAO conclude that Ajax would result in residual effects on the following wildlife valued components and indicator species:

- Loss and alteration of wetland habitat, direct mortality, and exposure to chemical hazards to great basin spadefoot;
- Loss and alteration of wetland habitat and exposure to chemical hazards to migratory birds, including waterfowl, sandhill crane, and great blue heron;
- Loss and alteration of grassland nesting and foraging habitat to raptors;
- Loss and alteration of grassland habitat, loss of lek sites and sensory disturbance at lek sites, and direct mortality to sharp tailed grouse;
- Loss and alteration of habitat, sensory disturbance, disruption of movement, and road mortality to American badger; and
- Loss and alteration of roosting habitat loss and exposure to chemical hazards to little brown myotis.

As discussed in section 6.3.2, the Agency and EAO understand that working group members raised concerns regarding insufficient baseline information, uncertainty in mitigation measures, and confidence in the assessment. The EAO has proposed an EA Certificate condition that would require KAM to complete supplemental pre-construction wildlife surveys, developed in consultation with relevant government agencies and Indigenous groups, prior to construction. The Agency and EAO acknowledge that KAM prepared a draft Wildlife Management and Monitoring Plan (February 17, 2017) that contains measures to avoid, reduce and offset impacts to wildlife. In consideration of key issues raised during the EA and the analysis of effects to wildlife valued components below, the EAO proposes an EA Certificate condition that would require KAM to develop and implement a Wildlife Management and Monitoring Plan in consultation with relevant government agencies and Indigenous groups.

6.4.1 *E*COLOGICAL CONTEXT

The Ajax local and regional study areas for vegetation and wildlife have been impacted by historical and current industrial, commercial, urban development and agricultural activities. These activities have affected the resiliency of wildlife due to impacts such as habitat loss, alteration and disruption to movement, particularly for species at risk.

6.4.2 AMPHIBIANS

Amphibians are vulnerable to a loss and alteration of wetland habitat, direct mortality reducing their overall population numbers, and increased chemical hazards that could affect growth and reproductive success.

Ajax would result in the loss or alteration (including sensory disturbance) of 50% of great basin spadefoot breeding habitat at the mine site. In total, there would be a loss or alteration (including sensory disturbance) of up to 74% of breeding habitat in the local study area, or up to 23% in the regional study area. However, suitable breeding habitat to support the spadefoot population will continue to exist in the local study area and regional study area during operations. Prior to construction, KAM would develop procedural guidance which would include salvage or relocation requirements, in the event that amphibian breeding or mass dispersal is identified.

The Agency and EAO note that KAM would compensate for approximately 28 hectares of lost wetlands, including amphibian breeding habitat. As noted in Vegetation (section 5), the EAO proposes an EA Certificate condition that would require a Wetland Offsetting Plan to be developed and implemented to compensate for wetland function loss. The Agency and EAO agree with KAM that the functions of wetlands can be difficult to replicate, which makes the effectiveness of this mitigation uncertain.

The Agency and EAO acknowledge that construction activities within the Ajax footprint and wildlife/vehicle collisions along migration corridors could result in amphibian mortality. Exposure to chemical hazards, such as contact water from the tailings storage area or in breeding habitats could result in reduced health and reproductive success for amphibians. The EAO proposes an EA Certificate condition for a Wildlife Management and Monitoring Plan that would require inclusion of measures to mitigate the effects associated with direct mortality and chemical hazards. Great basin spadefoot and western toad have a low resilience to wetland habitat loss, due to the limited availability of breeding habitat. In response, the EAO proposes an EA Certificate condition for a Wetland Offsetting Plan that would include wetlands that support amphibian breeding and a requirement that KAM monitor the effectiveness of the wetland function of offset areas.

After considering all relevant proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in residual effects on amphibians (great basin spadefoot) due to habitat loss and alteration, exposure to chemical hazards, and direct mortality. Residual effects are predicted to be low to medium in magnitude, site-specific to local in extent, long-term in duration, and sporadic to continuous in frequency. Habitat loss and alteration, and exposure to chemical hazards are predicted to be reversible; direct mortality is predicted to be irreversible. The effect of habitat loss and alteration would occur continuously until replaced wetland habitats are fully functional, which would take several years to achieve. The Agency and EAO have a low to moderate level of confidence based on the data provided, uncertainty in the effectiveness of KAM's proposed mitigation and wetland offsetting measures, including wetlands that would support amphibian breeding. Pre-construction surveys and monitoring would be required as part of the proposed EA Certificate conditions, including development and implementation of a Wildlife Management and Monitoring Plan to assess the effectiveness of mitigation and offsetting measures.

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to amphibian populations in the region.

6.4.3 MIGRATORY BIRDS

Migratory birds use waterbodies and riparian areas within the local study area, and Ajax would result in residual effects to migratory birds as a result of reduced wetland habitat, and increased chemical hazards that could affect growth and reproductive success to individuals.

Wetland-associated migratory birds, such as waterfowl, sandhill crane, and great blue heron, would be affected by the loss and alteration (including sensory disturbance) of 34% to 73% of wetland habitat in the local study area and up to 25% of wetland habitat in the regional study area. However, suitable wetland-associated migratory bird habitat will continue to exist in the local study area and regional study area during operations. Waterfowl, sandhill cranes, and great-blue heron have a low resilience to the loss of wetland habitat and exposure to chemical hazards. As previously noted, KAM would create wetland habitat compensation of offset the impacts during construction and operations, and would also include wetland and riparian features as part of the reclamation plan during closure. The effectiveness of the wetland offsetting measures is uncertain and would be closely monitored as per detailed monitoring plans to be developed in consultation with relevant government agencies and SSN. With successful wetland habitat compensation, the residual effects to migratory birds are expected to be reversible over the long-term.

The Agency and EAO acknowledge that migratory birds may be exposed to chemical hazards through exposure to mine-contact water infrastructure. With the implementation of mitigation measures in the Wildlife Management and Monitoring Plan, and the sporadic use of the area by migratory birds, the Agency and EAO anticipated that the effect of increased chemical hazards on migratory waterfowl would have a low likelihood of measurable effect on migratory bird populations. The Agency and EAO agree with ECCC, MFLNR, and SSN that KAM should monitor concentrations of COPCs in surface water, sediment, and aquatic plant tissue to determine if Ajax exacerbates currently high levels of COPCs and identify if further mitigation should be applied. As discussed in Vegetation (section 5) and Surface Water Quality and Quantity (section 2), the EAO has proposed EA Certificate conditions requiring KAM to include this monitoring as part of several plans, including the Surface water and Groundwater Mitigation and Monitoring Plans and the Fisheries and Aquatic Life Monitoring Plan. In addition, detailed monitoring plans would be developed, in consultation with relevant government agencies and SSN, as part of subsequent permitting for Ajax.

After considering all relevant proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in residual effects to migratory birds due to habitat loss and alteration, and exposure to chemical hazards. Residual effects are predicted to be low to medium in magnitude, local in extent, long-term in duration, sporadic to continuous in frequency, and reversible. The effect of habitat loss would occur continuously until replaced wetland habitats are fully functional. The Agency and EAO have a moderate level of confidence based on the data provided, and uncertainty in the effectiveness of KAM's proposed mitigation and wetland offsetting measures. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, including development and implementation of a Wildlife Management and Monitoring Plan to guide the assessment of the effectiveness of mitigation and offsetting measures.

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to migratory bird populations in the region.

6.4.4 RAPTORS

A number of raptor species utilize the local study area for nesting and foraging. The Agency and EAO consider that Ajax would result in a residual effect to raptors due to the loss and alteration (including sensory disturbance) of at least 56%, and additional potential alteration of another 10%, of raptor grassland nesting and foraging habitat in the local study area, which equates to a loss and alteration (including sensory disturbance) of between 5.7-6.7% of suitable available habitat in the regional study area. Short-eared owl, rough-legged hawk, great gray owl, and Swainson's hawk have a neutral resilience to nesting and foraging habitat loss, as none of these raptor species are dependent on any rare habitat features. The Agency and EAO note that KAM included measures in the Wildlife Management and Monitoring Plan, such as the installation of bird nesting boxes, avoidance of sensitive nesting sites and establishment buffers around active nests, if work must occur during sensitive periods. Flammulated owl and (occasionally) prairie falcon are understood to nest in cavities; therefore bird nesting boxes are likely to have limited effectiveness as a mitigation measure for raptors.

After considering all relevant proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in a residual effect on raptors due to habitat loss and alteration that is medium in magnitude, local in extent, far future (into the post-closure phase) in duration, and continuous in frequency. The residual effect is anticipated to be reversible as a result of reclamation and offsetting that is expected to create grasslands that would be useful to raptor species. The Agency and EAO have a moderate level of confidence based the data provided and uncertainty in the effectiveness of KAM's proposed mitigation and grassland offsetting measures, including bird nesting boxes. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, including development and implementation of a Wildlife Management and Monitoring Plan, to guide the assessment of the effectiveness of mitigation and offsetting measures.

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to raptor populations in the region.

6.4.5 NON-MIGRATORY GAME BIRDS

Sharp-tailed grouse are known to use the Ajax site year round, and there are four lek sites within or adjacent to the Ajax footprint. The Agency and EAO are of the view that Ajax would result in residual effects on sharp-tailed grouse due to loss and alteration of suitable habitat and known lek sites, decreased usage or abandonment of lek sites due to sensory disturbance, and mortality as a result of clearing and grubbing activities, heavy equipment use and wildlife vehicle collisions.

Project construction is expected to result in destruction and/or functional loss (including sensory disturbance) of 50-100% of lek sites for sharp-tailed grouse in the local study area, which equates to 18-36% of sites in the regional study area. As the sharp-tailed grouse provincial conservation status is blue-listed, the loss of sensitive sites could impact local sharp-tailed grouse populations. Sharp-tailed grouse has a low resilience to anthropogenic change, including loss of grassland habitat and leks sites, and sensory disturbance. Sensory disturbance (predominantly noise) would occur regularly for the duration of construction and operation, and could result in decreased lek usage and abandonment of nests. The Agency and EAO acknowledge KAM's commitment to creating replacement lek sites and monitoring their use until they are fully functional. Depending on the success of the artificial lek sites, the loss of leks is anticipated to be at least partially reversible. However, grouse are particularly vulnerable at lek sites, and the successful use of artificial lek sites is uncertain. The requirement for KAM to replace lek sites that are lost or functionally disturbed would be included as part of the EAO's proposed EA Certificate condition for a Wildlife Management and Monitoring Plan.

The Agency and EAO acknowledge that KAM committed to minimize the mortality of grouse eggs and hatchings by undertaking the clearing and grubbing work outside of the breeding window (April to September), as well as imposing speed limits along mine site roadways to reduce mortality effects from wildlife collisions. These mitigation measures would be included as part of the EA Certificate condition requirements for the Wildlife Management and Monitoring Plan.

After considering all relevant proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in residual effects on sharp-tailed grouse due to habitat loss and alteration, sensory disturbance, and direct mortality. Residual effects are predicted to be low to medium in magnitude, site-specific to local in extent, long-term to far future (into the post-closure phase) in duration, and sporadic to continuous in frequency. Sensory disturbance is predicted to be reversible; habitat loss and alteration, and direct mortality are predicted to be irreversible. Depending on the success of grassland restoration, the residual effect of habitat loss would likely be partially reversible for some grouse habitat requirements. The Agency and EAO have a low to moderate level of confidence based on the data provided, uncertainty in the effectiveness of KAM's proposed grassland mitigation and offsetting measures, including creation and successful use of artificial sharp-tailed grouse leks. Pre-construction surveys and monitoring are proposed by the EAO as EA Certificate conditions, including implementation of a Wildlife Management and Monitoring Plan to guide the assessment of the effectiveness of mitigation and offsetting measures.

Considering the above assessment, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to non-migratory game bird populations in the region.

6.4.6 MAMMALS

6.4.6.1 Badgers

The Agency and EAO are of the view that Ajax could result in residual effects to American badger due to the loss of suitable habitat, displacement from habitat due to sensory disturbance, disruption of movement related to fragmentation of habitat, and increased risk of road mortality reducing their population numbers. American badger has a low resilience to habitat loss and road mortality. As of 2012, the western BC American badger population has been estimated at 150 to 245 mature individuals.[26] The Thompson Badger Population Unit contains approximately 30-50 badgers.[27] Badgers in BC are found in many biogeoclimatic zones but preferences appear to be grasslands/fields or open-canopied forests. Although there have been some recent range expansions up mountain slopes in BC into areas where the forests have been cleared[28], overall the Thompson Badger Population Unit is continuing to decline.[29] Habitat loss, alteration, and fragmentation contribute to impeding American badger survival and recovery; however, road mortality, remains the single greatest threat to American badgers in British Columbia. Maintenance of a self-sustaining population is part of the BC recovery strategy for American badger.

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[26] British Columbia Badger Recovery Team. 2016. Recovery Plan for American badger (*Taxidea taxus*) in British Columbia. December 2016.

[27] *Ibid*.

[28] *Ibid*.

[29] Committee on the Status of Endangered Wildlife in Canada. 2012. Committee on the Status of Endangered Wildlife in Canada assessment and status report on the American Badger *Taxidea taxus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. iv + 63 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Badger utilization of the Ajax footprint and the local study area is well documented by the number of burrows (79% of the dig sites in the regional study area are located within the grasslands of the local study area). Ajax would result in direct and indirect loss of up to 55% of the available habitat in the local study area (up to 5% in the regional study area), the majority of which is considered moderate and high suitability habitat. Construction and operations of the access and mine roads, the powerline and waterline corridors and mine infrastructure would further fragment habitat and could disrupt and alter American badger migration between suitable habitat features. Habitat loss, alteration and fragmentation are known to be a key threat to American badger survival and recovery. KAM reported approximately 98,340 hectares of grasslands exist in the Thompson Basin, which overlaps the regional study area, that would still be accessible to American badger of which approximately 36% would be suitable for American badger. The level of fragmentation in the regional study area is uncertain.

Ajax would result in residual effects of sensory disturbance due to noise from daily blasting and vehicle traffic and increased lighting, both of which could contribute to badger displacement from dens. The Agency and EAO also acknowledge that American badger has some resilience to sensory disturbance, as badgers are known to burrow into and persist alongside railroad berms.

Road mortality is the primary cause of death for badgers in the region, and the Agency and EAO anticipate disruption to movement due to habitat fragmentation and displacement closer to roads that result from Ajax may contribute to the loss of a few individuals within the Thompson Badger Population Unit. These losses may not be offset by natural recruitment through reproduction and migration, and it is not certain how these losses would affect the Thompson Badger Population Unit. The Agency and EAO acknowledge mitigation measures of removing vegetation along roadsides to reduce badger/vehicle collisions and installing culverts under Inks Lake Road and at the upgraded interchange to facilitate badger wildlife crossing, as well as KAM's Traffic Management Plan that includes limiting speed limits on access roads and within the mine.

The Agency and EAO are of the view that mitigation measures in KAM's Wildlife Management and Monitoring Plan would reduce the effects of sensory disturbance and road mortality within the Ajax site. The Agency and EAO note that, to address the key effects of badger habitat loss and alteration, KAM would reclaim the mine site progressively, and has proposed a reclamation plan at closure that includes reclaiming grassland habitat to a condition that may be suitable for badgers. The Agency and EAO consider that mine site reclamation, which largely occurs at closure and would not reproduce the existing high-quality badger habitat within a timeframe relevant to badger lifecycles, is not mitigation for badger habitat loss.

As the loss of high-suitability badger habitat would last several decades, the Agency and EAO acknowledge that KAM has proposed to offset the impacts of lost and altered grassland habitat by conducting a restoration and enhancement program on KAM-owned land that is also within the regional study area, between 2 and 10 km from the Ajax footprint. The Agency and EAO note that a large portion of grassland enhancement proposed (forest thinning and shrub thinning areas on KAM-owned land) is located within approximately 1.5 km of, immediately adjacent to, and on either side of the Coquihalla Highway, south of the interchange with Highway 97; therefore any badgers using these areas could be at a higher risk of road mortality. KAM could not fully mitigate for road mortality to badgers. The success of the mine reclamation measures and the grassland restoration, and the utilization of restored grasslands by American badger, is uncertain. To address the temporal lag in effects prior to reclamation, and the permanent loss of some habitat due to the open pit, the EAO has proposed an EA Certificate condition requiring KAM to develop and implement a Grasslands Restoration and Enhancement Plan during construction and operations. The EAO has also proposed to include the requirement for KAM to enter into an agreement with the Province to support the jeffersoni Badger Recovery Team's recovery strategies, as part of the EA Certificate condition for a Badger Recovery Agreement.

After considering all relevant proposed mitigation measures, the Agency and EAO conclude that Ajax would result in residual effects on badgers due to habitat loss and alteration, sensory disturbance, disruption of movement, and direct mortality. Residual effects are predicted to be low to medium in magnitude, local to regional in extent, long-term to far future (into the post-closure phase), and sporadic to continuous in frequency. Sensory disturbance and disruption of movement are predicted to be reversible; habitat loss and alteration, and direct mortality are predicted to be irreversible. KAM is proposing to improve badger habitat in areas where badger habitat currently exists. It is not clear that grassland restoration as proposed by KAM will benefit badgers, and they may further impact badgers if they are forced to inhabit these areas given their proximity to roads. The Agency and EAO have a moderate level of confidence in the effects assessment for American badger, based on the data provided, uncertainties related to the effectiveness of KAM's proposed mitigation and grassland offsetting measures, and due to potential mortality from mine road or highway traffic adjacent to KAM's grassland habitat creation. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, including development and implementation of a Wildlife Management and Monitoring Plan to guide the assessment of the effectiveness of mitigation and offsetting measures.

Considering the above assessment, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to the self-sustaining badger populations in the region.

6.4.6.2 *Bats*

The Agency and EAO are of the view that Ajax would result in residual effects on bats due to loss of suitable habitat and increased chemical hazards that may affect growth and reproductive success of local bat populations.

Ajax construction is predicted to result in a loss of 22-42% of little brown myotis roosting habitat within in the local study area; however, this represents a very small (<0.008%) loss of similar habitat in the regional study area. Fringed myotis, little brown myotis, and western small-footed myotis, have low resilience to roosting habitat loss and exposure to chemical hazards. The Agency and EAO anticipate that bats would be able to move easily to other areas to forage and roost, and consider the habitat loss to be a low magnitude effect. The EAO has proposed an EA Certificate condition requiring that KAM conduct pre-construction surveys to determine bat activity and presence at hibernacula and roosting habitat, identify areas to avoid, and identify areas to install bat roosting boxes or additional compensation.

The Agency and EAO acknowledge that chemical hazards could affect bat health and reproductive success if they use contact water as a source of drinking water or feed on insects exposed to contact water. The EA Certificate condition for a Wildlife Management and Monitoring Plan includes measures to dissuade bats, and in particular little brown myotis, from using contaminated waterbodies for drinking water.

After considering all relevant proposed mitigation measures, the Agency and EAO conclude that Ajax would result in residual effects on bats due to habitat loss and exposure to chemical hazards. Residual effects are expected to be low in magnitude, site-specific to local in extent, long-term to far-future in duration, sporadic to continuous in frequency, and reversible. The Agency and EAO have a moderate level of confidence based on the data provided, and the uncertainties related to the effectiveness of KAM's proposed mitigation measures. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, including development and implementation of a Wildlife Management and Monitoring Plan to guide the assessment of the effectiveness of mitigation measures.

Considering the above assessment, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to bat populations in the region.

The Agency and EAO's characterization of the residual effects of Ajax on amphibians, migratory birds, raptors, non-migratory game birds, and mammals, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

6.4.7 *CUMULATIVE EFFECTS*

The Agency and EAO are of the view that past and present projects and activities, including urban development of the south areas of the City of Kamloops, the New Afton Mine, the Domtar Kamloops Pulp Mill, TMX, highway upgrades and projects, forestry, agriculture, ranching, and recreation activities, could contribute to cumulative effects on wildlife in the regional study area. Contributions from these past and present sources were captured by KAM in its description of baseline conditions. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual effects discussed above. These projects and activities were considered in the Agency and EAO's assessment of cumulative effects.

The Agency and EAO acknowledge that the National Energy Board imposed requirements on the approved TMX to mitigate and offset for impacts to grasslands. The EAO's proposed EA Certificate conditions would require KAM to implement wetlands offsetting and grasslands restoration that includes listed species-specific measures, such as the replacement of lek sites. It is anticipated that the incremental residual effects of Ajax would have minor interactions with other reasonably foreseeable projects or activities.

The Agency and EAO anticipate that there will be cumulative effects on amphibians as a result of (direct and indirect) habitat loss and alteration, and direct mortality. Great basin spadefoot and western toad have a low resilience to wetland habitat loss (due to the limited availability of breeding sites and a high ecological context) and direct mortality. As part of regional efforts to manage the cumulative effects of habitat loss and alteration, KAM has committed to supporting research initiatives outlined in the *Recovery Strategy for the Great Basin Spadefoot* (BC Ministry of Forests, Lands, and Natural Resources 2014) and the *Management Plan for the Western Toad* (Provincial Western Toad Working Group 2014).

The Agency and EAO are of the opinion that the cumulative effect to amphibians would be medium in magnitude, since the habitat loss and alteration and direct mortality is expected to remain below a level of effect that could exceed the resilience and adaptability limits of the amphibian population in the region. The Agency and EAO conclude that there would be no residual cumulative effects as a result of exposure to chemical hazards. Exposure to chemical hazards would be local in extent and the cumulative effects are predicted to subside over time, and it is expected that all other potentially interacting projects within the regional study area would be employing similar mitigation measures as Ajax for exposure management and these effects from other projects would therefore be negligible.

The Agency and EAO anticipate that there will be cumulative effects on wetland-associated migratory birds as a result of habitat loss and alteration. Waterfowl, sandhill cranes, and great-blue heron have a low resilience to the loss of wetland habitat. The Agency and the EAO are of the opinion that the cumulative effect to wetland-associated migratory birds would be medium in magnitude, since the habitat loss and alteration is expected to remain below a level of effect that could exceed the resilience and adaptability limits of the wetland-associated migratory bird population in the region. For the same reasons listed above, the Agency and EAO conclude that there would be no residual cumulative effects on wetland-associated migratory birds as a result of exposure to chemical hazards.

The Agency and EAO anticipate that there will be cumulative effects on raptors as a result of habitat loss and alteration. Short-eared owl, rough-legged hawk, great gray owl and Swainson's hawk have a neutral resilience to nesting and foraging habitat loss, as none of these raptor species are dependent on any rare habitat features. The Agency and EAO are of the opinion that the cumulative effect would be low in magnitude, since the habitat loss and alteration is expected to result in conditions that differ from the average value for baseline conditions, but remain within the range of natural variation of the regional raptor population.

The Agency and EAO anticipate that there will be cumulative effects on sharp-tailed grouse as a result of habitat loss and alteration and direct mortality. Sharp-tailed grouse has a low resilience to anthropogenic change, including loss of grassland habitat and leks sites, sensory disturbance, and loss of individuals due to mortality. KAM stated that there are large patches of intact grasslands on privately-owned land located southeast of Ajax (in the regional study area). The Agency and EAO note there is little information about the habitat suitability and the current or potential future fragmentation of these patches of grassland for sharp-tailed grouse. In terms of resiliency of nesting birds to noise, anthropogenic noise currently occurs in the Ajax area, and sharp-tailed grouse have been observed throughout the local study area. The Agency and EAO are of the opinion that the cumulative effect would be medium in magnitude, since the habitat loss and alteration, and direct mortality are expected to remain below a level that could exceed the resilience and adaptability limits of local and regional sharp-tailed grouse populations.

The Agency and EAO anticipate that there will be cumulative effects on badger as a result of habitat loss and alteration, disruption to movement, and direct mortality. Badger has a low resilience to habitat loss and loss of individuals due to road mortality. KAM stated that there are large patches of intact grassland located southeast of Ajax (in the regional study area); the Agency and EAO note there is little information about the habitat suitability, badger use of those areas, road density, and the current or potential future fragmentation of these patches of grassland for badger. The cumulative loss of suitable habitat could impact American badger populations locally and regionally, and sensory disturbance may result in a reduction of use of dig sites by badgers. The Agency and EAO are of the opinion that the cumulative effect would be medium in magnitude, since the habitat loss and alteration, disruption to movement, and direct mortality are anticipated to remain below a level that could exceed the resilience and adaptability limits of the regional American badger population. There is uncertainty in the magnitude of this cumulative effect due to the lack of information in the regional study area. Overall the American badger population is apparently continuing to decline and road mortality remains a key threat to American badgers in BC. Given the uncertainty about regional and cumulative impacts to American badger, the EAO has proposed an EA Certificate condition that would require KAM to provide support to the Province's Badger Recovery Team.

The Agency and EAO anticipate that there will be cumulative effects on bats as a result of habitat loss and alteration. Fringed myotis, little brown myotis, and western small-footed myotis, have low resilience to roosting habitat loss. The cumulative effects are expected to be low in magnitude due to the availability of suitable habitat, regional in extent, and far-future in duration. Cumulative effects are expected to result in conditions that differ from the average value for baseline conditions, but remain within the range of natural variation of the regional bat population. For the same reasons listed above, the Agency and EAO conclude that there would be no residual cumulative effects on bats as a result of exposure to chemical hazards.

It is anticipated that the incremental adverse residual effects of Ajax would have minor interactions with other reasonably foreseeable projects or activities. The Agency and EAO consider this cumulative effects conclusion to be to be highly uncertain, in particular for habitat availability and quality and potential mortality of species at risk whose populations are known to have low ecological resilience (great basin spadefoot, sharp-tailed grouse and American badger). There is low confidence in the analysis because of the lack of quantitative data assessments prepared by KAM and a lack of quantitative regional data for many species.

6.4.8 CONCLUSION

Considering the above assessments, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to wildlife, including amphibians, migratory birds, raptors, non-migratory game birds, and mammals.

Taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to wildlife.

7 Greenhouse Gases

7.1 BACKGROUND

This section provides a summary of the assessment of GHG emissions presented by KAM, a discussion of the key issues related to GHGs raised during the EA and proposed mitigation measures, as well as the Agency and EAO's assessment and conclusions related to the potential adverse effects of Ajax on GHGs in the context of provincial and national emissions.

GHGs are gases that trap heat in the atmosphere leading to warming of the lower levels of the atmosphere. The predominant GHGs in the earth's atmosphere are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2), and ozone (O_3). The scientific community has identified anthropogenic sources, such as the combustion of hydrocarbons, as the main cause of global climate change. Upon release into the local environment, GHGs disperse globally and are therefore considered a transboundary environmental effect for the purpose of the EA.

Both the federal and provincial governments have indicated a desire to reduce GHG emissions and have created strategic-level plans. Current provincial and federal legislation mandates the reporting of annual GHG emissions from industrial facilities.

7.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

7.2.1 ASSESSMENT METHOD

KAM focused its assessment on characterizing the relative contribution of Ajax to provincial and national emissions. All emissions are reported as CO_2 equivalents (CO_2e). For a given mixture of different GHGs, CO_2e identifies the quantity of CO_2 which would give the equivalent global warming potential of that mixture.

7.2.2 POTENTIAL EFFECTS AND MITIGATION MEASURES

Ajax would generate and emit GHGs as well as contribute to the ability of the local environment to sequester carbon. KAM identified the following activities as directly or indirectly emitting GHGs:

- Use of fuel in equipment and vehicles during construction and operation;
- Use of ammonium-nitrate fuel oil (ANFO) blasting agents during construction and operation;
- Passenger vehicles and concentrate trucks traveling to and from the mine site during construction and operation;
- Use of electricity purchased from BC Hydro during the operation phase; and
- Clearing of grasslands, forests, and removal of soil that function as "carbon sinks."

KAM estimated the GHG emissions for each of these categories during construction and operation (Table 12).

Table 12: Annual GHG emissions summary

Emission category	Construction (CO_2e tonnes per year)	Operation (CO_2e tonnes per year)
Use of fuel in equipment and vehicles on the mine site, and use of ANFO for blasting	77,652	104,603
Passenger vehicles and concentrate trucks traveling to and from the mine site	0[30]	10,822
Use of purchased electricity	1,820	5,065
Changes to ability of the environment to sequester carbon	2,538	2,538
Totals	82,010	123,028

KAM committed to the following mitigation measures to address GHG emissions:

- Maintenance of vehicles in good operating condition;
- Use of buses to transport crews to the mine site;
- Minimizing driving distances through access and haul road design;
- Minimizing the number of vehicle trips through selection of large trucks for ore and waste transport;
- Minimizing land clearing through the optimized placement of infrastructure; and
- Progressive reclamation (re-vegetation) of disturbed areas to advance the growth of plants which would sequester carbon.

7.2.2.1 *Comparison with Provincial and National Emissions*

KAM estimated the total annual GHG emissions from Ajax to be 82,010 CO_2e tonnes during construction and 123,028 CO_2e tonnes during operation. Ajax would represent 0.032% and 0.048% of provincial emissions during the construction and operation phases, respectively; and 0.011% and 0.016% of national emissions during the construction and operation phases, respectively.

7.2.2.2 *Comparison with other Projects*

KAM compared the emission intensity of Ajax, calculated as annual CO_2e per kilotonne of milled ore, to other mining projects. Based on the throughput of Ajax, the emission intensity is 4.8 tonnes of CO_2e . KAM described this value as conservative because it was based on the year with the highest anticipated GHG emissions. The emission intensity is comparable to other mining projects in BC.

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[30] The transmission line would be under construction for the duration of the construction phase.

7.3 DISCUSSION OF ISSUES

During the EA, members of the working group and the public raised concerns about climate change and methods for the assessment of GHGs.

The City of Kamloops commented that the emissions from Ajax would be equivalent to 20% to City of Kamloops emissions and to 13% of TNRD emissions inventories. KAM responded that the City of Kamloops and TNRD inventories apply only to government activities and does not include private businesses. KAM re-iterated its view that a comparison against provincial and national emissions is appropriate to assess Ajax's GHG emissions.

7.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

The Intergovernmental Panel on Climate Change's scientific consensus is that anthropogenic sources of GHG emissions are at levels that are altering the global climate. The Agency and EAO recognize that the impacts of GHG emissions must be addressed globally, and that it is not possible to estimate the impacts of an individual project's emissions on global climate change. In consideration of BC's responsibility to contribute to the global reduction, BC has legislated GHG reduction targets, supported by the *Carbon Tax Act*, that were established in the context of the best science about the necessary reductions to global GHG emissions to address impacts on global climate change. Individual projects are considered in relation to their contribution to provincial, national and international GHG emissions, as well as with the industry average of GHG.

The Agency and EAO accept KAM's estimated annual GHG emissions of 82,010 CO_2e tonnes during construction, and 123,028 CO_2e tonnes during operation. The Agency and EAO note Ajax's contribution to provincial and national GHG emission levels is relatively small.

The Agency and EAO note that KAM would be required to report GHG emissions annually to both the MOE and ECCC as part of statutory requirements. Ajax would exceed the 10,000 CO_2e tonnes reporting threshold of the provincial *Reporting Regulation of the Greenhouse Gas Reduction (Cap and Trade) Act* for all years of construction and operation. Ajax is also expected to exceed the 50,000 CO_2e tonnes per year reporting threshold set out in the Greenhouse Gas Emissions Reporting Program under the *Canadian Environmental Protection Act, 1999*. KAM would need to calculate and report Ajax emissions resulting from the use of fuel in equipment and vehicles, and use of ANFO for blasting.

The Agency and EAO accept that mitigation measures proposed by KAM are reasonable for mitigating GHG emissions, and note that KAM will have to comply with provincial legislation for managing GHG emissions and will be subject to the provincial carbon tax. The Agency notes that KAM subscribes to the Towards Sustainable Mining initiative, which encourages its members to take measures to increase energy awareness, manage GHG emissions, and track and report GHG emissions as part of business decisions.

The Agency and EAO consider the residual GHG emissions from Ajax to be low in magnitude based on a comparison of Ajax emissions to provincial and national emission inventories. Effects would be far future in duration because of the persistence of GHGs, global in extent, and irreversible. Considering the above assessment and the implementation of mitigation measures proposed by KAM, the Agency and EAO conclude that Ajax is not likely to be a significant contributor to GHGs emitted within British Columbia or Canada.

The Agency and EAO recognize that the assessment does not analyze upstream GHG emissions (e.g. production of mining equipment or purchased materials) associated with Ajax. For projects in the mining sector, the Agency and EAO are of the view that upstream emissions are marginal compared to the direct and indirect emissions which are described above. As a result, the Agency and EAO's analysis of the effects of GHG emissions focused on the downstream emissions.

The Agency and EAO's characterization of the residual effects of Ajax on GHGs, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

8 Air Quality

8.1 BACKGROUND

This section provides a summary of the assessment of potential effects of Ajax on air quality as identified by KAM, the mitigation measures proposed by KAM to address those effects, and a discussion of the key air quality issues raised during the EA. It also sets out the analysis and conclusions of the Agency and EAO related to the potential adverse effects of Ajax on air quality.

Changes in concentrations of criteria air contaminants (CACs) can affect ecological values, socio-economic values, and human health. The results of this assessment inform the following assessments: surface water (section 2), vegetation (section 5), property values (section 16), and human health (section 10).

In BC, air quality effects are assessed using a suite of ambient air quality objectives and standards that have been developed provincially and nationally to inform decisions on the management of air contaminants. These are the Provincial Air Quality Objectives, National Ambient Air Quality Objectives, and Canadian Ambient Air Quality Standards.

8.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

The criteria that KAM used to evaluate the effects of Ajax on air quality are referred to as "applicable regulatory criteria" and are shown in Table 13. These are the most stringent of the Provincial Air Quality Objectives, National Ambient Air Quality Objectives, and Canadian Ambient Air Quality Standards. KAM selected these substances based on professional judgment, in consideration of the types and quantities of substances that would be emitted from Ajax and previous experience with similar projects. The substances assessed and the approach for modelling were outlined in an approved Detailed Dispersion Modelling Plan.

Table 13: Applicable Air Quality Criteria[31]

Substance	Averaging Period	Applicable Regulatory Criteria	Units
Dustfall[32]	30-day	1.7	mg/dm^2/day
Total suspended particulates (TSP)	24-hour	120	µg/m^3
	Annual	60	µg/m^3
Particulate Matter with a diameter of < 10 microns (PM_{10})	24-hour	50	µg/m^3
Particulate Matter with a diameter of < 2.5 microns ($PM_{2.5}$)	24-hour	25	µg/m^3
	Annual	8	µg/m^3
Sulphur Dioxide (SO_2)	1-hour	200	µg/m^3
	24-hour	150	µg/m^3
	Annual	30	µg/m^3
Nitrogen Dioxide (NO_2)	1-hour	188	µg/m^3
	24-hour	200	µg/m^3
	Annual	60	µg/m^3
Carbon Monoxide (CO)	1-hour	14,300	µg/m^3
	8-hour	5,500	µg/m^3

Source: Modified from KAM's Application for an Environmental Assessment Certificate/Environmental Impact Statement, December 2015.

8.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

The local study area was established to capture direct project effects, whereas the regional study area captured potential effects that could interact with Ajax's predicted effects (i.e. cumulative air quality effects). The local study area for the air quality assessment is 30 km by 30 km, centered on the Ajax site. KAM identified that project components are located within 2 km of the closest residential area of the City of Kamloops, the neighbourhood of Aberdeen, which is northeast of Ajax. The neighbourhoods of Sahali, West End/Downtown, North Shore, and Brocklehurst are located north of Aberdeen. The agricultural area of Knutsford and several ranching residences are within 1 km of the boundary of the Ajax footprint. Kamloops Indian Reserve No. 1 is adjacent to the City of Kamloops. The local study area includes all of these neighbourhoods, agricultural areas, and part of Kamloops Indian Reserve No. 1. Within the local study area, a smaller area known as the plant boundary defines the limits of where public access is restricted and within which occupational health and safety criteria for worker exposure apply. The plant boundary was defined for Ajax following the BC MOE Guidelines for

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[31] The objectives listed in this table are those that were in use at the time when KAM prepared the EIS/Application.

[32] The objectives for Dustfall were rescinded in 2011 and are no longer included in the most recent list of BC Air Quality Objectives.

Air Quality Dispersion Modelling[33] and generally includes a 500 m buffer from the from the edge of features such as the open pit, mine rock storage facilities, tailings storage facility, access road, and the perimeter of the existing and anticipated project disturbed area. The regional study area for the air quality assessment is 55 km by 70 km, located on and extending to the north of Ajax.

Data from continuous monitoring stations in the Kamloops area indicate that measured background concentrations of SO_2, NO_2, and CO are always below the applicable regulatory criteria.

Measured background concentrations of TSP, particulate matter with a diameter of less than 10 microns (PM_{10}) and particulate matter with a diameter of less than 2.5 microns ($PM_{2.5}$) occasionally exceed the applicable regulatory criteria. KAM indicated that these exceedances are often episodic, driven by external forces such as a forest fire, or are the consequence of local domestic and industrial emissions that accumulate when meteorological conditions result in poor dispersion. However, KAM also noted that the annual average concentration of $PM_{2.5}$ is 9.1 $\mu g/m^3$, which is above the provincial objective of 8 $\mu g/m^3$. The highest $PM_{2.5}$ values were measured in the Kamloops valley bottom.

Existing anthropogenic sources of air emissions in the region include transportation, heating, industry, and particulate matter and dust from roads and disturbed lands. Combustion emissions from vehicles are the largest source of CO in the region. Traction dust emissions from paved roads are the largest source of TSP and PM_{10} emissions in the region. Industrial emissions are considered the largest source of $PM_{2.5}$, SO_2 and nitrogen oxides (NO_X).

KAM described the climatic conditions of the Ajax area as arid or semi-arid, with low annual precipitation and high evaporation. In the summertime, the Ajax area can be very dry. Due to the topography, stable atmospheric conditions and temperature inversions can cause air pollutants to accumulate in the Kamloops valley bottom. These conditions are more common during the winter, which is also when home heating emissions in the city are generally highest. The highest continuously measured $PM_{2.5}$ concentrations are in the valley bottom; measured concentrations outside of the valley (e.g. in neighbourhoods such as Aberdeen) are much lower.

Modelled Base Case

KAM used the CALPUFF air dispersion model to determine background air quality values for the air quality assessment. The modelled base case includes all existing emissions in the regional study area, plus global/regional background concentrations that account for emissions sources outside of the regional study area.

KAM indicated that air quality at the Ajax site is dominated by emissions from outside of the regional study area and is largely unaffected by industrial and space heating sources within the City of Kamloops. KAM found that maximum base case concentrations of SO_2, NO_2 and CO were below the ambient air quality objectives at all locations, while maximum base case concentrations of 24-hour TSP, PM_{10}, and $PM_{2.5}$ and dustfall exceeded the applicable regulatory criteria within the City of Kamloops. The maximum base case concentrations of PM_{10} and $PM_{2.5}$ were in the Kamloops valley bottom. Base case modelling results were consistent with measured background air quality concentrations.

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[33] Guidelines for Air Quality Dispersion Modelling in British Columbia. British Columbia Ministry of Environment, Environmental Protection Division, Environmental Quality Branch, Air Protection Section. March 2008.

8.2.2 KAM EFFECTS AND PROPOSED MITIGATION MEASURES

KAM identified the following potential effects to air quality from Ajax:

- Changes in the concentrations of CACs at ground level as a result of:
    - combustion emissions from mobile equipment/vehicles;
    - blasting;
    - fugitive dust from project activities (e.g. road dust from haul-road traffic); and
    - wind erosion of exposed surfaces at the mine site.

KAM indicated that emissions during construction and operations phases would be much higher than in the closure and decommissioning and post-closure phases.

Key construction phase activities that would generate emissions include earthworks, stockpile development, construction of mine site components such as access roads and storage facilities, open pit development (including drilling, blasting, crushing, loading, hauling and deposition of mine rock), and development of the tailings storage facility.

Key operations phase activities that would affect air quality include open pit development (including drilling, blasting and hauling mine rock and ore), crushing and conveying ore, development of the temporary ore stockpile, development of the mine rock storage facilities, earthworks, operation of the processing plant, operation of the tailings storage facility, site road use and maintenance, and storage and transport of concentrate.

Key mitigation measures that KAM proposed to avoid or minimize the potential effects of Ajax on air quality include:

- A covered conveyor from the crusher to the plant;
- Covered ore stockpiles;
- Installation of dust collectors on the primary crusher, coarse ore reclaim area, cone crusher area, fine ore stockpile reclaim, and high pressure grinding roller area;
- A partially-enclosed primary crusher;
- Minimized haul distances;
- Minimized height from which materials are dropped;
- Application of water on the tailings beach and haul roads to maintain appropriate moisture content and minimize wind erosion and fugitive dust emissions;
- Application of dust suppressants on the tailings beach and haul roads, if required, to supplement watering and suppress dust;
- Use of polymers in the tailings thickening process to bind fine particles to prevent dust generation, and direct application of polymers to the tailings beach as required;

- Deposit tailings in the tailings storage facility by rotating the spigots to ensure that all areas regularly receive fresh (moist) tailings to prevent the generation of fugitive dust;
- Application of surfactants to the haul roads to improve water efficiency;
- Routine grading, compacting and maintenance of roadways, particularly haul roads, to reduce silt content;
- Reclamation of exposed surfaces prone to wind erosion to minimize generation of fugitive dust; and
- Re-vegetation of disturbed areas (e.g., progressive reclamation), where practical and economically achievable, to minimize generation of fugitive dust.

KAM developed a Fugitive Dust Management Plan that further described the proposed mitigation and monitoring of particulate matter (TSP, PM_{10}, $PM_{2.5}$) and dustfall, including an approach for adjusting mitigation, as necessary, based on monitoring results. See section 8.2.5 for further details.

Air Dispersion Modelling

KAM used the CALPUFF air dispersion model to predict ground-level concentrations of CACs for the years with the predicted worst-case emissions during the construction and operations phases of Ajax. KAM's dispersion modelling was undertaken in accordance with the approved Detailed Dispersion Modelling Plan and the Addendum Model Plan. For meteorological inputs, KAM's model used data from 2003, 2004, and 2005, and analyzed the 2003 results in more detail, since this year produced the highest predicted ground-level CAC concentrations at the plant boundary (compared to sensitivity analyses using meteorological inputs from other years from the available meteorological dataset). KAM indicated that using this worst case meteorological year would result in the most conservative estimates of CAC concentrations.

The emission sources that KAM considered in the air dispersion model include diesel engine emissions, explosive detonation emissions, and fugitive dust emissions.

KAM modelled the following air quality scenarios:

- **Base case** (discussed above) considers all existing emissions, including global/regional background values;
- **Project case** considers the emissions from Ajax alone; and
- **Application case** considers both base case and Project case emissions and represents the overall predicted air quality conditions.

KAM modelled ground-level concentrations of CACs for the construction and operations phase, and focused on the operations phase since the construction phase is of a shorter duration and has fewer stationary sources. The results from the operations phase were considered to represent the worst-case emissions from Ajax.

8.2.3 KAM'S CONCLUSIONS ON RESIDUAL EFFECTS

KAM identified the following residual effects to air quality:

- Increase in ground-level concentrations of CACs (TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO) and dustfall during the construction and operations phases.

KAM identified haul roads as the dominant source of particulate matter emissions from Ajax. KAM predicted ground-level concentrations of TSP, PM_{10} and $PM_{2.5}$ for scenarios of 90%, 80%, and 70% effectiveness of mitigation of dust from haul roads, as well as a 0% short-term upset case. KAM committed to achieving 90% mitigation of dust from haul roads and modelled the lower mitigation scenarios as sensitivity analyses. The predicted concentrations were used as inputs to the human health risk assessment (HHRA). Refer to section 10 for information regarding the assessment of health effects.

8.2.3.1 *Project Case (Operations Phase)*

KAM predicted that the maximum project-alone ground-level concentrations of all CACs would be less than the applicable regulatory criteria, except for 24-hour TSP, 24-hour PM_{10} and 24-hour $PM_{2.5}$. KAM indicated that the highest concentrations of these CACs would occur at the plant boundary and would decrease rapidly with distance from the plant boundary. These concentrations would decrease to below the applicable regulatory thresholds by upper Aberdeen in the 90% mitigation scenario. However, for the 80% and 70% mitigation scenarios, Ajax alone concentrations of 24-hour PM_{10} would exceed the applicable regulatory criteria in upper Aberdeen.

8.2.3.2 *Application Case (Operations Phase)*

KAM predicted that 24-hour average TSP, 24-hour average PM_{10}, and 24-hour average $PM_{2.5}$ would exceed the applicable regulatory criteria under all haul road mitigation scenarios at the plant boundary. The maximum predicted 24-hour average TSP, 24-hour average PM_{10}, and 24-hour average $PM_{2.5}$ were located at the plant boundary. Elevated concentrations of these CACs exceeding the applicable regulatory criteria also occurred in other areas of Kamloops including the West End/Downtown and the North Shore, similar to the base case conditions; KAM attributed these exceedances to existing sources of emissions in the City of Kamloops and indicated that they are not caused by Ajax.

KAM predicted that dustfall and annual average $PM_{2.5}$ concentrations would slightly exceed the applicable regulatory criteria at the plant boundary for the 70% haul road mitigation scenario only. KAM noted that elevated concentrations of these parameters were also predicted in other areas of Kamloops, similar to the base case conditions.

For all other CACs, KAM indicated that the maximum predicted concentrations for the Application Case were less than the applicable regulatory criteria under all haul road mitigation scenarios.

In upper Aberdeen, KAM indicated that under all haul road mitigation scenarios, there would be days throughout the year where the emissions from Ajax would cause the Application Case concentrations to exceed the 24-hour average air quality objective for PM_{10}. KAM indicated that exceedances of the objective in upper Aberdeen were predicted to occur 7 days of the year under the 90% haul road mitigation scenario, 10 days of the year under the 80% haul road mitigation scenario, and 21 days of the year under the 70% haul road mitigation scenario. The maximum predicted concentration of 24-hour PM_{10} that could be experienced on days where the objective is exceeded is approximately twice the air quality objective for the 90% scenario. For the 80% and 70% scenarios, the maximum predicted concentration would increase to approximately three and four times the objective, respectively. KAM indicated that the exceedances were typically predicted to occur during the winter months, under poor dispersion conditions.

KAM noted that changes in haul road mitigation effectiveness produced noticeable effects on ground-level concentrations of TSP, PM_{10} and $PM_{2.5}$ near the plant boundary, but that the effect was less noticeable with distance from the site and almost indistinguishable in downtown Kamloops. KAM indicated that sources such as transportation, heating, industry, and particulate from roads and disturbed land in in the valley bottom, were responsible for the elevated maximum predicted particulate matter concentrations in the valley bottom.

8.2.4 CUMULATIVE ENVIRONMENTAL EFFECTS

KAM identified other activities having the potential to interact cumulatively with the emissions from Ajax, including industrial activities, natural resource extraction, and transportation. The base case accounted for cumulative effects, as it incorporated the air emissions from existing sources in the regional study area, including transportation, heating, industry, and dust and particulate matter from roads and disturbed land. The base case also accounts for global/regional background emissions from sources outside of the regional study area by adding a background value to model predictions. KAM did not quantify air emissions from reasonably foreseeable projects and activities such as expansion and growth of the City of Kamloops, as information relating to these predicted emissions was not available. KAM indicated that additional mitigation measures were not required.

8.2.5 MONITORING AND FOLLOW-UP

KAM proposed to verify the air quality effects predictions and the effectiveness of mitigation measures by developing and implementing an Air Quality Management Plan, which would describe regulatory monitoring and reporting requirements. KAM's Fugitive Dust Management Plan would be implemented in conjunction with the Air Quality Management Plan and would describe the specific mitigation measures, monitoring, and approach to adaptive management that KAM would apply for emissions of particulate matter (TSP, PM_{10}, $PM_{2.5}$) and dustfall. As part of this plan, KAM committed to establishing a public complaints procedure that would describe KAM's protocol for recording and responding to complaints from the public, and implementing feasible and reasonable measures to address issues raised.

KAM's conceptual Fugitive Dust Management Plan included a combination of proactive dust control measures and reactive measures in the event of upset conditions or extreme events. The plan described a Dust Action Response Plan that identified preliminary trigger levels based on differences between measured upwind and downwind air quality conditions, and corresponding levels of mitigation response that KAM would implement up to, and including, curtailment of operations. KAM proposed that the Dust Action Response Plan would be supported by three permanent air quality monitoring stations, including a station upwind of the mine and a station downwind of the mine that would continuously monitor particulate matter, in order to inform on-site decision making. KAM proposed that the monitoring stations include the existing Ajax Upwind station on Stake Lake road, the existing Pacific Way Elementary School station in upper Aberdeen (downwind), and one additional station whose location would be determined in consultation with MOE during the permitting phase, should Ajax proceed. KAM noted that all conceptual plans for managing and monitoring air quality, including the preliminary proposed trigger levels, would continue to be refined through the life of Ajax in consideration of operational experience.

8.3 DISCUSSION OF ISSUES

During the EA, members of the working group and the public raised concerns related to the potential effects of Ajax on air quality. This section provides a summary of the key issues raised and KAM's responses.

8.3.1 BASELINE EXCEEDANCES

MOE, HC, the City of Kamloops, Interior Health, and members of the public raised the concern that the City of Kamloops already experiences periods of exceedances of the applicable regulatory criteria for $PM_{2.5}$. Reviewers were concerned about adding further air pollution to the airshed. In particular, HC, IHA, and Kamloops Moms for Clean Air noted that any additions to $PM_{2.5}$ emissions from Ajax would increase health risks.

MOE's policy[34] indicates that a greater understanding of model uncertainties should be sought and emissions should be reduced in cases where measured $PM_{2.5}$ concentrations are approaching or exceeding the provincial objective for annual average $PM_{2.5}$. The policy also indicates that proponents should be expected to contribute to a robust monitoring network to ensure protection of the environment and human health.

KAM acknowledged that any increases in $PM_{2.5}$ would increase health risk and committed to minimizing emissions to the extent practical. Refer to section 10 for the assessment of effects on human health that considers inhalation exposures.

8.3.2 EFFECTIVENESS OF PROPOSED MITIGATION MEASURES

MOE, ECCC, HC, SSN, IHA, the City of Kamloops, and members of the public raised concerns regarding KAM's proposed mitigation measures for fugitive dust emissions, particularly from the haul roads. MOE, ECCC, the City of Kamloops, and HC questioned whether KAM would be able to continuously achieve a minimum of 90% mitigation efficiency for dust from haul roads. Members of the public including the Kamloops Moms for Clean Air, Kamloops Area Preservation Association, and the Aberdeen Neighbourhood Association were concerned that local air quality in the neighbourhoods closest to the mine, such as upper Aberdeen, would be adversely affected by Ajax. Kamloops Moms for Clean Air stated that the results in the EIS/Application represent the most optimistic, best-case scenario and recommended that at least three emissions scenarios be considered including full, partial, and failed mitigation.

KAM's air dispersion modelling incorporated active mitigation[35] for the haul roads and tailings storage facility emission sources. For haul roads, KAM applied a dust control efficiency of 90%, consistent with KAM's commitment to achieving this level of mitigation. For the tailings storage area, KAM applied a dust control efficiency of 70% that KAM considered typical of frequent application of dust suppressants.

During the review period, the Agency and EAO required KAM to provide sensitivity analyses for scenarios of 70% and 80% active mitigation of dust from haul roads, as well as a short-term "upset case" scenario of 0% active mitigation on haul roads. The results of the sensitivity analyses confirmed that roads are a major contributor to predicted particulate concentrations and that a decrease from 90% to 80% haul road mitigation effectiveness doubled the particulate matter concentrations. Predicted ground-level concentrations of $PM_{2.5}$ at the plant boundary increased as the effectiveness of haul road mitigation decreased, but the trend was less noticeable with distance from Ajax. In downtown Kamloops, KAM indicated that predicted concentrations of $PM_{2.5}$ remained relatively unchanged with changes in haul road mitigation effectiveness. KAM concluded that Ajax's contribution to particulate matter concentrations in downtown Kamloops is very small and that other sources are responsible for the elevated maximum predicted concentrations in the downtown area.

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[34] Policy for Permitting Air Emissions in Airshed that Exceed the PMC2.5 Air Quality Objectives. MOE. November 9, 2016.

[35] Active mitigation is mitigation applied in excess of nature. For all emissions sources, including the haul roads and tailings storage facility, KAM applied a natural mitigation factor of 45% to account for natural mitigation that would be provided by rain or snow cover. This was done for only the annual statistics, and not for the 1-hour and 24-hour average statistics.

KAM indicated that the 0% active haul road mitigation scenario was a hypothetical scenario that would not realistically occur, due to the number of water trucks and the occupational hazard to haul truck traffic resulting from no mitigation that would result in roadways becoming completely dry. MOE noted that although the 0% scenario is not realistic for longer averaging intervals such as annual averages, it was possible for short-term failure of mitigation to occur. MOE suggested that local nuisance effects could occur if mitigation failed (e.g. water trucks stopped functioning) during extreme meteorological conditions, such as a dry period with high winds. KAM disagreed with MOE's views regarding the plausibility of the 0% mitigation scenario. Per KAM's proposed Fugitive Dust Management Plan (and accompanying Dust Action Response Plan), KAM committed to ensuring that relevant operations would not be conducted in the absence of adequate roadway mitigation. MOE noted that mitigation of dust from haul roads would likely be critical, should Ajax proceed.

During the review period, the Agency and EAO directed KAM to provide evidence that mines operating under similar conditions have achieved 90% mitigation efficiency for dust from unpaved haul roads, and the specific measures that KAM would apply to mitigate dust emissions from haul roads by 90%. KAM submitted information regarding two studies related to dust mitigation in support of the proposed 90% mitigation efficiency for dust from haul roads. However, MOE and the City of Kamloops noted that this information did not provide strong evidence that 90% mitigation of dust from haul roads could be successfully implemented at Ajax. ECCC, MOE, and the City of Kamloops reiterated their concern that KAM's mitigation may be less effective than 90%, which could result in underestimation of $PM_{2.5}$ and PM_{10} emissions.

During the review period, KAM provided two iterations of a Fugitive Dust Management Plan (which included a Dust Action Response Plan) that provided additional details on proactive and reactive dust control measures. Key proactive measures for dust emissions from the haul roads and tailings storage facility are described in Table 14 below. Reactive measures included actions that KAM would implement in the event of unexpected circumstances that lead to the generation of dust and/or the dispersion of dust to sensitive receptors. The plan also included monitoring of meteorological conditions and ambient air quality, the results of which would inform adjustments to mitigation.

Table 14: KAM's Control Measures to Minimize Generation of Fugitive Dust from Haul Roads and the Tailings Storage Facility

Source	Routine Mitigation Measures	Contingency Mitigation Measures
Haul Roads	• Daily visual inspection of active areas • Road maintenance • Adjust road surfacing materials • Application of water • Apply surfactants to improve water efficiency • Use of dust suppressants • Construct windbreaks (berms) along the haul roads	• Adjust and minimize number/length of active haul routes during periods of extended dry conditions and high winds to reduce the generation of fugitive dust • Localized and temporary haul truck speed restrictions in areas of concern during periods of extended dry conditions and high winds
Tailings Storage Facility	• Daily visual inspection • Rotate spigot points to keep the tailings beach surface wet • Use of polymer to bind fine particles to coarser particles to prevent dust generation • Construct the tailings embankment above the tailings beach to act as a windbreak • Compact snow on inactive areas of the tailings beach • Progressive reclamation • Wet suppression	• Use of straw bales for windbreaks and crimped straw in the tailings to stabilize the surface • Use of dust suppressants to control fugitive dust from the tailings beach surface • Use of polymer to seal the tailings beach surface • Water cannons, snowmakers, and sprayers as dust suppression on the tailings storage facility • Placement of straw bales and other material on the tailings beach for wind breaks • Crimp straw into the tailings beach to stabilize the tailings

Source: Modified from 1207_KAM_Fugitive Dust Management Plan, December 2016

8.3.3 Revisions and Corrections to Air Dispersion Modelling

MOE, ECCC, the City of Kamloops, SSN, and community groups including the Kamloops Moms for Clean Air and the Kamloops Area Preservation Association, raised questions regarding the inputs and assumptions that KAM applied to the air quality modelling and calculations. Reviewers also questioned how the tailings storage facility would change over time and how the model considered emissions from this evolving source.

In response to these comments, and following technical discussions with the working group, KAM provided updated air quality results that included:

- Revised blasting emissions including corrections to the blasting unit conversion errors and an updated emissions calculation method;
- Revised haul truck emissions that addressed inconsistencies in the haul truck engine horsepower data; and
- Revised emissions from the tailings storage area, modelled as time-varying[36] emissions, to more realistically account for the location and size of the dry tailings area (tailings beach), and to better represent the potential for erosion and dust emissions during high wind speed events.

The updated results showed substantial increases in SO_2, NO_2 and CO, although predicted concentrations still remained well below the applicable regulatory criteria. For particulate matter, the updates generally resulted in small increases in the predicted concentrations. KAM indicated that these updates did not change the conclusions of the air quality assessment.

8.3.4 DUST STORMS

MOE, Interior Health, the City of Kamloops, and SSN raised concerns regarding the potential for Ajax to contribute to dust storms and questioned how these high-intensity events could affect ambient air quality and related values such as human health. MOE indicated that dust storms are known to occur from other local sources in the area such as the Highland Valley Copper tailings and the Copper Mountain tailings dam during periods of high winds in dry conditions, typically in the summertime. Reviewers noted that dust storms are highly visible and often short-lived, and questioned how they were captured in the dispersion model.

In its updated air quality results, KAM used time-varying emission factors to model the emissions from the tailings storage facility to better represent the potential dust emissions during high wind speed events. The revised approach to modelling was conducted as per the approved Addendum Modelling Plan. The resulting maximum 1-hour concentrations increased, while the longer-term averaging intervals were lower or remained the same (depending on receptor location). The updated results showed dust being carried further away from the mine site under periods of high winds and dry conditions. The distribution pattern was reflective of the prevailing southwest winds at the site.

MOE indicated that the time-varying approach produced more realistic distributions of the maximum predicted concentrations that accounted for short-term high wind speed events. However, MOE noted that this approach was not applied to other emission sources that would also be expected to exhibit a similar time-variance, such as the mine rock storage facilities and haul roads. MOE and the City of Kamloops indicated that the air dispersion model, therefore, did not capture high wind events from sources at the mine site other than the tailings area, given the use of constant emission factors for these sources in the model. KAM agreed, but noted that the modelling was undertaken in accordance with the approved Addendum Modelling Plan and that the use of constant emission factors produces higher overall predicted concentrations compared to the time-varying approach. Notwithstanding, MOE and the City of Kamloops noted that the use of constant emissions factors tended to under-estimate concentrations in drier months, and possibly over-estimate concentrations in the winter.

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[36] CALPUFF requires an emission rate for each hour of the years that are modelled. The time-varying emission factor that KAM applied for the tailings storage facility considered variations in wind speed, precipitation and snow cover for each hour of the year modelled, whereas the original approach in the EIS/Application used the same emission rate for all modelled hours.

MOE concluded that it is possible for short-duration, high-intensity wind storms at Ajax to produce very high PM_{10} concentrations for periods less than an hour. These dust storms may not necessarily result in exceedances of the 24-hour PM_{10} objective, but could cause noticeable local effects to residents closest to the mine site. MOE noted that air dispersion models are not designed to estimate short-term events. MOE also acknowledged that there are challenges in responding effectively to dust events and cautioned that not all dust events and exceedances can be fully mitigated, all of the time. Refer to section 10 for the assessment of effects to human health from inhalation and other exposures from Ajax.

8.3.5 PROPOSED APPROACH TO MONITORING AND MANAGEMENT

MOE, MEMPR, ECCC, IHA, the City of Kamloops, and SSN raised questions regarding KAM's proposed approach to monitoring, verifying effects, and managing air quality at Ajax. Kamloops Moms for Clean Air and other members of the public raised questions related to the compliance reporting that KAM would be required to undertake. MOE acknowledged that the details of monitoring and management would be determined through the permitting process (should Ajax proceed) but stated that consideration of these issues during the EA process was required due to the scale and proximity of Ajax to the City of Kamloops. Reviewers noted that robust monitoring and management would be critical for managing air quality at Ajax.

KAM provided an updated Fugitive Dust Management Plan during the review period that included predictive meteorological forecasting, predictive air dispersion modelling, and real-time air quality monitoring to guide operations and mitigation actions. Within the plan, a Dust Action Response Plan described the sequence of response actions (up to and including curtailment of operations) that KAM would take in the event of observed conditions or trends that have potential to lead to exceedances of the air quality objectives. The plan identified preliminary trigger thresholds corresponding to meteorological conditions that have potential to increase generation and accumulation of dust in the upper Aberdeen area.

MOE indicated that KAM's proposed monitoring and management approach is reasonable, but that further details would be required in KAM's application for a permit under the *Environmental Management Act,* should Ajax proceed. MOE noted that parts of KAM's plan were based on model outputs and cautioned that the approach carries uncertainty associated with the air dispersion model. MOE further noted that the plan could be very effective in responding to situations where there is a gradual increase in ambient concentrations, but that it would be less effective in dealing with short-term events which, by their nature, would allow very little time to respond to trigger levels. Finally, MOE noted that there could potentially be issues where there is no practical or economically feasible solution and that not all dusting events and exceedances can be fully mitigated, all of the time. KAM responded by reaffirming their commitment to effectively mitigate fugitive dust emissions and remain in compliance with any permit issued by MOE under the *Environmental Management Act* or be subject to enforcement action.

8.3.6 OTHER SOURCES OF UNCERTAINTY IN THE AIR QUALITY ASSESSMENT

A common thread in many of the issues raised by reviewers was the uncertainty in the air quality assessment. Sources of uncertainty that have already been discussed in this report include the effectiveness of KAM's proposed mitigation measures, the use of constant emission factors, the challenges in predicting and responding to short-term dust storms, and the use of predictive modelling in KAM's proposed monitoring and management approach.

MOE and ECCC indicated that fugitive dust emissions are one of the least well-characterized and most difficult emissions to estimate for use in dispersion modelling. MOE noted that the largest source of uncertainty is related to the emission factors, but that there is also uncertainty related to the dispersion model itself. The upper bound of the uncertainty in the model output is unknown, but MOE noted it is larger than the accepted factor of two that is typically applied for CALPUFF.

MOE, SSN, and the Kamloops Area Preservation Association raised the issue that haul roads were estimated to have a 5% silt content in the EIS/Application and that 5% may not be a conservative value for estimating emissions from haul roads. Reviewers noted that 5% was at the lowest end of the range specified by guidance from the United States Environmental Protection Agency. MOE and SSN noted that doubling the silt content of haul roads has the effect of doubling the emission rate.

HC, MOE, ECCC, SSN, the City of Kamloops, and members of the public raised questions regarding KAM's selection of the worst case years for the construction and operations phases. Reviewers were concerned that key activities such as construction of the access road were not included in the years that KAM had selected and that, therefore, these years may not represent true worst case emission scenarios. SSN and members of the public also indicated that dust emissions from wind erosion of the open pit may be underestimated in KAM's predictions. At the EAO's request, KAM provided further rationale for its selection of the worst-case modelling years and confirmed that these years corresponded to the greatest amount of material movement and highest predicted emissions.

MOE noted that part of the $PM_{2.5}$ emissions from haul roads is due to diesel engine emissions from the operation of haul trucks. In the dispersion modelling, KAM assumed that older diesel engines (which are no longer in production) would be used at Ajax. This assumption may over-estimate the $PM_{2.5}$ emissions if KAM were to use newer Tier 4 haul trucks. KAM responded to MOE's comments by indicating that Tier 4 haul trucks may not be available for use at Ajax, and that KAM would prefer the flexibility to purchase trucks with proven technology.

8.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

8.4.1 AIR QUALITY

In consideration of KAM's proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in the following residual effects to air quality:

- Increase in ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, and dustfall; and

- Increase in exceedances of BC Ambient Air Quality Objective for 24-hour average PM_{10} in upper Aberdeen.

Ajax would cause an increase in ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, and dustfall that would be highest at the plant boundary. Ajax's contribution to these concentrations would decrease rapidly with distance from the mine site. Concentrations of SO_2, NO_2, and CO are predicted to remain well within applicable regulatory criteria; however, concentrations of 24-hour TSP, 24-hour PM_{10}, and 24-hour $PM_{2.5}$ are predicted to exceed the applicable regulatory criteria at the plant boundary. By upper Aberdeen, these concentrations would decrease to within applicable regulatory criteria, except for 24-hour average PM_{10}.

The Agency and EAO consider there to be substantial uncertainty associated with the air quality effects assessment, which affects the confidence in the estimated frequency of 24-hour average PM_{10} exceedances in upper Aberdeen. The Agency and EAO are of the view that 90% mitigation of dust from haul roads is unlikely to be achieved on a continuous basis at Ajax. The Agency and EAO also note that haul roads are the dominant source of emissions from Ajax, and find that effective dust management would be critical to managing air quality, should Ajax proceed. The Agency and EAO find that there would be approximately 7 to 21 days per year where Ajax would result in concentrations of 24-hour average PM_{10} that exceed the BC Ambient Air Quality Objective of 50 $\mu g/m^3$ in upper Aberdeen. The Agency and EAO are of the view that the frequency of these exceedances is likely closer to the upper bound of this range, but could possibly be higher. On these days, the maximum predicted concentration of PM_{10} could potentially be approximately twice the provincial objective at the lower end of this range, and would increase linearly with decrease in mitigation effectiveness. Most of the exceedances would be expected to occur during the winter months under poor dispersion conditions.

In the summertime, upper Aberdeen and other neighbourhoods near Ajax would also experience short-term dust storms, which would produce very high concentrations of PM_{10} for periods of less than an hour. These short-term events may not cause exceedances of the 24-hour average PM_{10} criteria, but would be objectionable to nearby residents. Dust storms already occur under baseline conditions in the region and are typically associated with dry conditions and high winds. The tailings storage facility is expected to be the dominant source of emissions at Ajax during these short-term events. The Agency and EAO note that dust storms would be challenging to manage because of their short time-frame and high intensity.

The Agency and EAO accept KAM's findings that Ajax's contributions to air quality in downtown Kamloops would be negligible to measure, relative to other anthropogenic sources. Areas of Kamloops further away from the mine site would continue to experience periods of elevated particulate matter concentrations due to sources other than Ajax.

The results of the air quality assessment inform other valued component assessments, including water quality and human health. There are numerous sources of uncertainty in the air quality assessment which, when used as inputs to related valued component assessments, affect the level of confidence in those assessments; refer to the Agency and EAO's conclusions for those valued component assessments for a description of the level of confidence specific to that assessment. Most of the uncertainty in the air quality assessment is related to the emission factors and how they were applied in the air dispersion model; this includes haul road mitigation factors and the use of constant emission factors for sources other than the tailings storage facility. The Agency and EAO find that the air dispersion modelling undertaken for Ajax was comprehensive and consistent with the approved Detailed Dispersion Modelling Plan and the Addendum Model Plan. The CALPUFF air dispersion model is the best regulatory dispersion model available for estimating ground-level concentrations of air pollutants for Ajax; however, the uncertainty in the model output is still greater than a factor of two.

The sensitivity analyses for haul road mitigation effectiveness reinforced the importance of successful mitigation of fugitive dust from haul roads and other sources at Ajax, and robust monitoring and adaptive management. The Agency and EAO acknowledge that it is not feasible to monitor mitigation effectiveness directly. KAM's proposed Fugitive Dust Management Plan identified preliminary air quality trigger levels that are based on differences between measured upwind and downwind air quality conditions, and corresponding levels of mitigation that KAM would implement up to, and including, curtailment of operations. KAM's proposed monitoring and trigger-based adaptive management plan would be supported by three permanent air quality monitoring stations, including a station upwind of the mine and a station downwind of the mine that would continuously monitor particulate matter, in order to inform on-site decision making and adaptive management. The Agency and EAO find that KAM's proposed approach would likely be effective in responding to conditions where there is a gradual accumulation of contaminants (such as during winter inversions), but that it would be less effective in detecting and responding to short-term dust storms.

To support an overall air quality management strategy for Ajax, and to help address uncertainties related to the air quality effects assessment, the EAO is proposing an EA Certificate condition that would require KAM to develop and implement an Air Quality Management and Monitoring Plan that would include the mitigation, verification, and adaptive management measures that KAM would implement to reduce fugitive dust emissions from Ajax, up to and including curtailment of operations. The plan would build upon KAM's proposed Fugitive Dust Management Plan and would describe the levels of air quality contaminants that would initiate adaptive management. The plan would also include notification and reporting requirements. The EAO is also proposing an EA Certificate condition that would require KAM to retain the services of an Air Quality Reviewer who would be responsible for conducting regular data quality reviews of KAM's monitoring data, and providing information to stakeholders, including government agencies, Indigenous groups, and the public. The Agency and EAO acknowledge that there are also comprehensive requirements under the *Environmental Management Act* regarding air quality monitoring and management that KAM would be required to follow, should Ajax proceed. The Agency and EAO also note MOE's view that Ajax is likely to require the most comprehensive and complex monitoring and mitigation systems that have been attempted for any mine in BC.

In consideration of the proposed mitigation measures and EA Certificate conditions, the Agency and EAO find that the effects of Ajax on air quality would be an increase in ground-level CAC concentrations that would cause measurable exceedances of the BC Ambient Air Quality Objective for 24-hour average PM_{10} in upper Aberdeen for approximately 7 to 21 days per year, typically during winter months. The frequency of exceedances is expected to be closer to the upper bound of this range, but could possibly be higher. Upper Aberdeen and other neighbourhoods near Ajax would also experience short-term dust storms, primarily during summer months, which would produce very high concentrations of PM_{10} for periods generally lasting less than an hour and would be difficult to manage. The Agency and EAO find that these effects would be sporadic, since the atmospheric conditions that exacerbate these conditions would occur sporadically. The effect would be experienced within the regional study area, but is expected to be greatest near the mine site. The duration would be long-term, extending through construction into closure, when the cessation of operations and reclamation efforts would decrease the dust emissions. The air quality effect would be reversible in the long term, since ambient air quality levels would be expected to recover to baseline conditions after project closure.

The Agency and EAO's characterization of the residual effects of Ajax on air quality, as well as the level of confidence in the effects determination of the potential residual effects, are summarized in Appendix A.

8.4.2 CUMULATIVE EFFECTS

The Agency and EAO are of the view that past and present sources of air emissions, including industrial activities, natural resource extraction, and transportation, could contribute to cumulative effects to air quality in the regional study area. Contributions from these past and present sources were captured by KAM in its description of the baseline conditions (i.e. the base case). The base case also included global/regional background emissions from sources outside of the regional study area such as the Highland Valley Copper Mine, agriculture, ranching, and the Kamloops Airport. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual effects discussed above.

The Agency and EAO are of the view that increased emissions from growth and expansion of the City of Kamloops in the future could potentially add to the predicted change in concentrations of CACs caused by Ajax. The additive effect of future increased emissions from the City of Kamloops in combination with the residual effects of Ajax could result in a cumulative effect to air quality in the regional study area. Forest fires and other extreme, but infrequent, events could occasionally also contribute to cumulative effects to air quality. The Agency and EAO are of the opinion that the characteristics of cumulative effects to air quality would depend on the extent of development of the City of Kamloops and the severity of any extreme events such as forest fires.

8.4.3 CONCLUSION

The Agency and EAO evaluated changes to air quality as a pathway valued component. Changes in air quality have the potential to affect ecological and socio-economic values, as well as humans, which are the ultimate receptors. The results of the air quality assessment inform the assessment and the significance determinations for the following valued component assessments: Surface Water Quality and Quantity (section 2), Vegetation (section 5), Property Values (section 16), and Human Health (section 10).

9 Noise and Vibration

9.1 BACKGROUND

This section provides a summary of the assessment of potential effects of noise and vibration as presented in KAM's EIS/Application, a discussion of the key issues related to noise and vibration raised during the EA and proposed mitigation measures, and the Agency and EAO's assessment and conclusions related to the potential adverse effects of noise and vibration.

The assessment of noise for Ajax was informed by: the British Columbia Oil and Gas Commission's (OGC) British Columbia Noise Control and Best Practices Guideline (2009)[37], through consideration of permissible sound levels (PSL) at residences; HC's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (2017)[38] which uses the percent highly annoyed (%HA) indicator to determine how noise effects may affect humans living in proximity to developments; and the World Health Organization 2009 guidelines[39] which identify sound thresholds and levels for potentially impacting sleep disturbance. KAM relied on US Environmental Protection Agency and Alberta Energy Regulator Guidelines to establish baseline noise levels.

The assessment of vibration annoyance effects on humans was informed by the Australian and New Zealand Environment Council (ANZECC) Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration[40]; and vibration effects to building structures followed the Ontario MOE and Climate Change's Guidelines on Information Required for the Assessment of Blasting Noise and Vibration[41]. KAM's assessment of the effect on aquatic life is outlined in section 9.2.3.3 below. The Agency and EAO's assessment of effects to fish and fish habitat is in section 4.

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[37] The OGC BC Noise Control Best Practices guidance is available here: www.bcogc.ca/node/8152/download

[38] HC's noise assessment guidance is available here: https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidance-evaluating-human-health-impacts-noise.html

[39] The World Health Organization (WHO) sleep disturbance guidance is available here: http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf

[40] The ANZECC guideline is available here: http://www.epa.nsw.gov.au/resources/noise/anzecblasting.pdf

[41] An online PDF of this document is not available.

9.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

9.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

KAM recorded baseline noise conditions to evaluate instances where model predictions exceeded the OGC guidelines or HC guidance. Baseline monitoring shows that only one recorded level was slightly (1 dBA) above the OGC recommended baseline sound level. Seasonal and meteorological conditions can affect the baseline sound levels. Vibration baselines were not quantified since baseline vibration levels are typically below the threshold of human perception.

9.2.2 NOISE EFFECTS AND MITIGATION MEASURES

KAM acknowledged that noise and vibration has the potential to adversely affect human health, wildlife, ranching and livestock, current use, aquatic life, and property values either directly or indirectly. In their noise assessment, KAM assessed noise impacts by modelling exceedances of established noise thresholds that are known to:

- Disrupt or annoy humans during the daytime; and
- Disrupt sleep for humans at night.

Vibration impacts were assessed by modelling potential exceedances of established vibration thresholds determined to:

- Disrupt or annoy humans;
- Damage the structural integrity of buildings and related infrastructure; and
- Cause changes in behaviour or mortality of fish species.

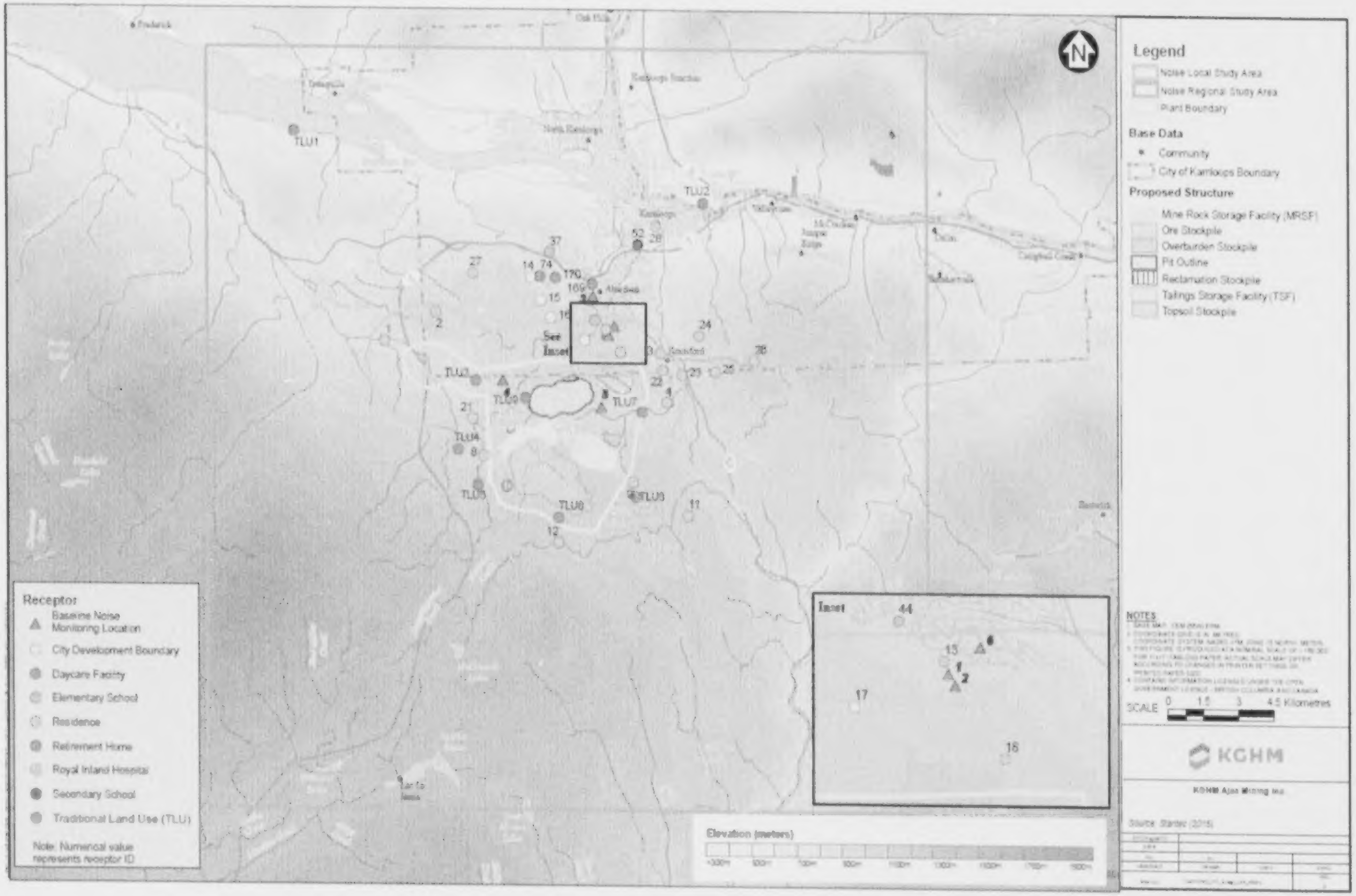
KAM modelled noise and vibration outputs by project phase and year, and determined that the first year of construction and operation years 2, 4, and 8 were considered representative of the worst cases for noise and vibration emissions. The effects of noise and vibration differ in their spatial characteristics. As such, separate noise and vibration assessments, including different regional and local study areas were established.

9.2.2.1 *Annoyance*

Ajax has the potential to affect ambient daytime noise levels during construction as a result of clearing and grubbing, blasting, vehicle traffic, and crushing, loading, hauling of mine rock, and other construction activities such as piling work on the Jacko Lake dam.

KAM's assessment showed that the predicted average noise levels during construction remain below baseline at all but 4 residential receptor locations which are likely to experience perceptible noise effects. KAM noted that during the piling activities noise effects at some traditional land use (TLU) receptors are substantially above the baseline. The predicted daytime level of 71.6 dBA at the Jacko Lake prayer tree TLU receptor location is 32.6 decibels above the baseline daytime sound level of 39 dBA. The TLU receptor locations at Inks Lake and Peterson Creek Discharge have similar high levels of noise effect from the piling activities, a period expected to last roughly 2-3 months (see Figure 6 for receptor locations).

Figure 6: Noise study area and receptor locations



Legend
Noise Local Study Area
Noise Regional Study Area
Plant Boundary
Base Data
Community
City of Kamloops Boundary
Proposed Structure
Mine Rock Storage Facility (MRSF)
Ore Stockpile
Overburden Stockpile
Pit Outline
Reclamation Stockpile
Tailings Storage Facility (TSF)
Topsoil Stockpile
Receptor
Baseline Noise Monitoring Location
City Development Boundary
Daycare Facility
Elementary School
Residence
Retirement Home
Royal Inland Hospital
Secondary School
Traditional Land Use (TLU)
Note: Numerical value represents receptor ID
TLU1
TLU2
TLU3
TLU4
TLU5
TLU6
TLU7
TLU8
TLU9
Kamloops
Aberdeen
Knutsford
See Inset
Inset
Elevation (meters)
NOTES
SCALE 0 1.5 3 4.5 Kilometres
KGHM
KGHM Ajax Mining Inc.

Source: EIS/Application – Figure 10.5-1

KAM's noise assessment showed no exceedances of the HC 6.5%HA threshold during construction.[42]

Noise effects during operations would be related to open pit development, hauling mine rock, crushing and conveying ore, and other ancillary activities. Modelled noise effects at receptors near Knutsford, Edith Lake, and receptors near the city development boundary would be above baseline conditions and thus perceptible; however the predicted sound levels would comply with OGC PSL thresholds at all residential receptors in all operation scenarios.

No exceedances of the HC %HA threshold were recorded for operations at any of the receptor sites[43].

To address potential noise effects from construction and operations activities, KAM identified the following mitigation measures:

- Covered conveyor and coarse ore stockpile enclosure to attenuate equipment activities;
- Heavy equipment located inside buildings;
- Roads designed to minimize haul distances;
- Use of best available noise suppression technology on pile driving equipment;
- Large trucks for ore and mine rock transport to minimize trips; and
- Mobile equipment equipped with the manufacturer-recommended exhaust mufflers.

KAM stated that mitigation of noise effects through project operations would occur through the following management practices and procedures:

- Keep all operating equipment building doors and windows closed to the extent possible;
- Limit the use of vehicle horn during each shovel and haul truck loading cycle to the extent allowed by safety regulations;
- Maintain vehicles in good operating condition and operate vehicles within posted speed limits;
- Use multi-passenger vehicles to transport crews to reduce overall traffic noise emission;
- Conduct piling activities only during the daytime period;
- Select best achievable technology for mine fleet equipment;
- Reduce vehicle idling and minimize rapid starts and stops; and
- Regularly maintain all machinery and equipment.

9.2.2.2 *Sleep Disturbance*

In the EIS/Application, KAM applied a sleep disturbance noise guideline of 42 dBA (outside, during nighttime). KAM reported that the nighttime equivalent sound level from Ajax is below 42 dBA at all residential receptors for both construction and operation phases. KAM concluded that there would be no noise-related sleep disturbances of nearby residents from Ajax during the nighttime period.[44]

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[42] During review KAM was required to apply a rural residence adjustment to their noise assessment and to undertake a maximum noise level assessment. The results are outlined in the discussion of issues below.

[43] Ibid.

9.2.3 VIBRATION EFFECTS AND MITIGATION MEASURES

KAM assessed the potential for human annoyance due to vibration effects from earthworks, site road construction, use and maintenance, open pit development, and drilling and blasting.

9.2.3.1 *Annoyance*

KAM compared predicted blast-related vibration results to the human annoyance threshold of 5 mm/s for ground vibration and 115 dBL for air blast overpressure. All receptors were below the thresholds for human annoyance with the exception of the area 1a (12.31 mm/s and 128 dBL); and area 1b (6.96 mm/s and 125 dBL) both in the eastern portion of Jacko Lake. The nearby Jacko Lake prayer tree TLU site would also exceed the annoyance thresholds for vibration and air blast over pressure. KAM stated that there would be enforced minimum buffer distances from the blasting zone area boundary which exceed the distance to the sites listed above, thus an effect to a receptor is considered unlikely. Prediction results at all other receptors were below both annoyance thresholds.

9.2.3.2 *Building Structure and Integrity*

The predicted ground vibration level at the City growth boundary is 2.09 mm/s. At the closest residential receptor, the predicted level is 1.70 mm/s. These levels are substantially lower than the minimum vibration level required to cause cracks in drywall of 19 mm/s. As a result, KAM concluded that it is highly unlikely that mine related blasting could cause structural damage to any of the free standing structures in the surrounding communities.

The predicted air blast level at the closest residential structure was 112 dBL. This and other predicted air blast levels for all homes, industrial structures and towers were below the structural damage threshold of 133 dBL and the cautionary limit of 120 dBL. Thus, KAM contends that it is also highly unlikely that any air blast could cause cosmetic or structural damage.

9.2.3.3 *Protection of Aquatic Wildlife*

KAM used a vibration threshold of 13 mm/s and a threshold of <100kpa for underwater overpressure for protection of aquatic life in Jacko Lake adopted from DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat. To comply with the vibration threshold, KAM noted that the maximum weight of explosives per delay would be incrementally reduced from 1,020 kg in Zone 1 to 68 kg beyond Zone 3. The vibration guideline for aquatic life at Jacko Lake dictates the blast design because the damage threshold for aquatic life is lower than the residential damage threshold of 19 mm/s and Jacko Lake is closer to the open pit than other residential receptors. As a result, KAM expects that the ground vibration and air blast levels at Jacko Lake would meet the aquatic life vibration guideline threshold in all blast scenarios.

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[44] During review, the EAO required additional sleep disturbance assessment using maximum noise levels.

The Agency and EAO's assessment of effects from blasting and sheet pile dam installation is in section 4 of this report.

KAM stated that mitigation of vibration effects through project operations would occur through the following management practices and procedures:

- Manage and revise the controllable blast design parameters on an ongoing basis as needed;
- Monitor ground vibrations to determine if changes to blast design or procedures are necessary to reduce vibration;
- Test blasts or smaller blasts would be used to incrementally "scale up" to full blast to ensure vibration levels remain below guideline thresholds;
- Use weather stations to monitor unfavourable atmospheric conditions, and modify blast procedures accordingly; and
- Use electronic detonators for blasting.

Mitigation of vibration effects by project design would be achieved through careful blast design. The detailed vibration mitigation measures are presented as follows:

- Blast designs would reduce annoyance effects from blast-induced air blast overpressure;
- Use of decreasing maximum explosives mass per time delay for the different blast zones;
- Use of lower mass explosives at Jacko Lake to be in compliance with the aquatic life vibration guideline;
- Design ole diameter sizes, number of decks, and stemming configurations for different zones; as well, only one hole/delay would be fired on the blast; and
- Minimum time delay between holes in all blasts, and row time delays incremented from the front of the blast towards the back.

9.2.4 MONITORING AND FOLLOW-UP

KAM intends to develop and implement a Noise and Vibration Management Plan that would address in detail mitigation of the noise and vibration effects outlined above. Additional mitigation measures for vibration effects during construction and operations are summarized under the Construction Environmental Management Plan, the Explosives Management Plan, the Fisheries and Aquatic Life Monitoring Plan, the Wildlife and Vegetation Monitoring Plan, and the Community Engagement Plan.

9.2.5 RESIDUAL NOISE EFFECTS

KAM concluded that, after implementation of mitigation measures, Ajax would result in the following residual noise effects:

- Human annoyance due to daytime noise and vibration; and
- Sleep disturbance due to nighttime noise.

During construction, residual noise effects were noted at three city development boundary receptors, four rural residence receptors, and two traditional land use receptors showing that noise may more frequently be above the baseline but would generally be below guideline thresholds at these sites. The east end of Jacko Lake during piling work neared guideline thresholds and may exceed them if noise mitigations are insufficient, suggesting that recreationalists and Indigenous groups using the area would be annoyed and/or have their activities disturbed.

For operations, KAM noted some residual noise effects. Of note, residual effects at four rural residences were acknowledged suggesting residents at these locations would perceive noise levels above the background/baseline level and may be annoyed or disturbed under certain conditions.

KAM concluded that the residual noise effects would have a regional geographic extent, long term duration, and would occur continuously. KAM said that while the noise effects may be perceptible to the population at times, the changes in noise levels are not expected to exceed the noise thresholds established by the OGC and WHO.

9.2.6 RESIDUAL VIBRATION EFFECTS

Vibration effects were described as a change in vibration environment, quantified by ground vibration and air blast over pressure levels at receptors during construction and operation.

KAM stated that, following mitigation, the vibration effects at all receptors would be below the thresholds for structural damage and the aquatic life vibration guideline.

Vibration impacts at the east end of Jacko Lake and at the Jacko Lake prayer tree due to blasting and piling activities exceeded human annoyance thresholds suggesting that recreationists and Indigenous groups utilizing the area would be disrupted or annoyed by vibration during blasting and/or piling activities.

KAM characterized the vibration effects as minor in magnitude, regional geographic extent, and occurring regularly during construction and operations. The vibration effects are not expected to exceed structural vibration damage limits for any receptor. KAM noted that although the vibration effects may be perceptible at times, the level is expected to be below the human annoyance threshold at all receptors with the exception of the east end of Jacko Lake during blasting in the western portion of the pit.

9.2.7 CUMULATIVE NOISE AND VIBRATION EFFECTS

KAM identified nine nearby sources of noise related to forestry, ranching, agriculture, recreational hunting and fishing, other nearby mines, and the Coquihalla highway. These noises were quantified in the baseline sampling for the noise assessment. KAM noted that Ajax would contribute to the baseline sound levels and be perceptible above baseline at times. KAM determined that there would be no cumulative vibration effect.

9.3 DISCUSSION OF ISSUES

Throughout the EA, noise and vibration from Ajax were identified as a key issue of concern. Based on the feedback from the working group and the public, the principle issue identified was the noise and vibration model assumptions and uncertainties in KAM's assessment as a result. The issues specific to each are summarized below.

9.3.1 USE OF AVERAGES IN NOISE AND VIBRATION ASSESSMENT

The working group and the public noted that the use of average noise data without providing the maximum modelled noise outputs has the effect of masking events that may exceed baseline levels or guideline thresholds and thus, does not allow for a nuanced understanding of noise effects. In particular, comments from the Kamloops Area Preservation Association requested maximum noise levels for residences near the east mine rock storage facility. The EAO requested information for maximum (A-weighted) sound levels for all noise receptors during the day and night and required KAM to re-evaluate the WHO sleep disturbance assessment.

As per WHO (2009) Sleep Disturbance Guidelines, KAM applied a sleep disturbance noise guideline of 56 dBA (outside, during nighttime). With the exception of two rural residential receptors (receptors 8 and 9), the modelled maximum noise levels were below the 56 dBA threshold at all residential receptors for both construction and operation phases. Prior to mitigation, at receptor 8, noise levels were estimated to be up to 62.2 dBA during some operations years; at receptor 9 noise levels were estimated to be to up to 56.6 dBA during some operation years. For potential sleep disturbance scenarios, KAM committed to mitigation measures which target both the magnitude of sound emissions and the frequency of occurrence as follows:

- Use of radio communication instead of a warning horn during the nighttime period in areas identified where noise exceedances may occur;
- Use of “non-tonal” type backup alarms for mobile equipment;
- Utilize a mobile equipment dispatch system to optimize mobile equipment movement and minimize equipment congestion; and
- Review and calibrate performance of equipment dispatch software to limit equipment congestion in noise sensitive areas.

To mitigate potential sleep disturbance effects, KAM proposed the use of “non-tonal” visual backup alarms for haul trucks on the main embankment of the TSF, the east area of the MRSF, and the west area of the reclamation stockpile.

Following mitigation, noise assessment results are below WHO thresholds (56 dBA) for residence 9 while residence 8 is slightly above (56.2 dBA), suggesting the potential for a residual effect at this receptor.

The working group and the public also raised concerns about KAM’s use of average airblast and vibration values instead of upper bound predictions (or 95% confidence intervals) in the vibration assessment. Under a 95% confidence interval assessment, vibration and airblast levels remained below guidelines at all receptors except for the Aquatic Life Protection Vibration Guideline at Jacko Lake. KAM noted this would require reducing charge sizes from 68 kilograms (kg) to 43 kg to avoid potential impacts to aquatic species, and committed to undertake all measures necessary to comply with the 13 mm/s vibration criteria for Jacko Lake.

KAM stated that it is committed to comply with all applicable vibration and air blast thresholds. To this end, KAM stated that they would develop a blast management plan that includes the following mitigation measures to maintain blast effects below applicable regulatory thresholds:

- implementation of the practice of “scaling up” from a small blast in the initial project phase;

- Vibration monitoring locations will be setup in a linear array from the pit to the closest resident (i.e. Aberdeen community) to provide daily record of blast effect at different distances;
- If 80% of the targeted ground vibration of 5 mm/s, and/or 80% of the targeted airblast level of 115 dBL is obtained, an investigation will be conducted to determine if the trends will continue on future blasts. Appropriate blast design changes will be made, when warranted; and
- Daily blast effect records provide opportunities for corrective action if the effect approaches the design target.

KAM also noted that further refinement of the blast management plan would occur during *Mines Act* permitting.

9.3.2 CONSIDERATION OF RURAL RESIDENCES

The City of Kamloops requested the application of a rural residence adjustment to the noise assessment to account for the rural character of the proposed project site. Under HC Guidelines, a rural residence adjustment may be applied where there is a greater expectation for, and value placed on, "peace and quiet" which under the guidelines is equivalent to up to 10 dBA in noise. KAM provided a revised assessment for %HA at residential receptors in a memo dated October 17, 2016. Under the rural residence adjustment it was determined that the 6.5% threshold would be exceeded at:

- Residence Receptor #21 during piling activities (7.89%HA);
- Around Inks Lake during construction (10.69 %HA), operations year 2, 4, and 8 (14.08 %HA); and
- Jacko Lake prayer tree site during piling activities (81.16 %HA revised from 58.17 %HA) as well as during operations year 4 (8.54 %HA) and year 8 (12.12 %HA).

KAM identified the following mitigation measures specific to piling activities and haul road noise which they stated will reduce exceedances of the %HA threshold at the affected locations:

- Temporary shielding around the pile driver;
- Management of the piling duration and time period (i.e. shorter period during the day time only);
- Selection of the best available equipment with the lowest noise emission;
- Construction or earth berms or other noise barriers around Inks Lake during construction; and
- Application of noise mitigation techniques as outlined in section 10.5.4.2 of the application to reduce effects at the Jacko Lake prayer tree to below %HA thresholds.

9.3.3 IMPACTS OF VIBRATION ON SLOPE STABILITY

The Aberdeen Neighbourhood Association raised concerns about slope stability, in particular the potential for blast vibration to reactivate historic landslides in the Aberdeen Hills area. The Association also raised concerns about impacts to building integrity as a result of vibration and air overpressure during blasting. The working group requested additional information on the potential vibration effects on slope stability.

In their technical memo responding to these concerns, KAM stated that slope stability impacts in the Aberdeen neighbourhood would be negligible and that they are highly confident in their slope stability assessment for the Aberdeen neighbourhood. KAM committed to monitor vibration levels using an array of fixed and mobile seismographs once full scale production blasts are carried out. KAM also committed to convening a Community

Liaison Group to review monitoring results. The EAO notes that working group members from MEMPR and MFLNR also expressed satisfaction with the results of KAM's slope stability assessment.

The Agency and EAO note that potential vibration effects from blasting will be further assessed during *Mines Act* permitting by MEMPR.

9.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

After considering all relevant proposed mitigation measures, the Agency and EAO conclude that Ajax would result in residual effects on noise. In consideration of information provided in the EIS/Application and additional information provided during the review phase, and in consideration of the blast exclusion zones identified by KAM, the Agency and EAO are satisfied that KAM has demonstrated there would not be residual vibration effects to human receptors or to structural integrity from Ajax. Vibration effects on aquatic species are assessed in section 4 of this report.

The Agency and EAO acknowledge that Ajax has the potential to produce noise that may disrupt or annoy residents in proximity to the mine site during the day time and the potential to disrupt the sleep of residents at night.

The Agency and EAO acknowledge that during construction and operations, average modelled noise emissions do not exceed baseline conditions or OGC and HC thresholds at residential or institutional receptors (daycares, schools, hospitals, and retirement homes) located within the current Kamloops city boundaries. Overall, the Agency and EAO conclude that, on average, mine related noise levels at residential and institutional receptors would tend to blend into the acoustic baseline or be slightly audible above background levels, and would therefore be unlikely to disrupt or annoy human receptors with any frequency during construction and operations.

At various times during the construction period, the Agency and EAO note that the average noise effects at residential receptors in rural locations (receptor #8, #9, and #21), the city development boundaries (receptor #16, #17, #18) and traditional land use receptors (TLU3, TLU7, TLU9) exceed the baseline suggesting that, on average, human receptors at these sites are more likely to hear mine activities, possibly on a more frequent basis, than the residential and institutional receptors outlined above. Although all residential receptors comply with OGC PSL thresholds[45] during construction, following the application of the rural residence adjustment, the HC %HA threshold is exceeded for one rural residence (#21) and the Jacko Lake prayer tree (TLU 9) and Inks Lake (TLU 3) traditional land use sites.

The Agency and EAO note that the home at receptor #21 (located approximately 1.5 km from Jacko Lake) would experience noise effects resulting in a 7.89 %HA rating during the 2-3 month pile driving period required for dam construction. KAM contends that mitigation would reduce the annoyance effect below the 6.5%HA threshold and committed to a noise monitoring program. To help ensure compliance with the guideline thresholds for noise, the EAO proposes EA Certificate conditions that would require KAM to develop noise and vibration management and monitoring plans. These plans would require KAM to monitor and take corrective action to reduce noise and vibration exceedances that affect nearby residences should they occur. In consideration of the mitigation measures and the proposed EA Certificate conditions, the EAO estimates that residual noise effects at receptor #21 would remain below the 6.5%HA threshold during piling activities.

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[45] OGC guidelines do not apply to institutional and traditional land use receptors.

The Agency and EAO note that, under the same rural residence adjustment, the TLU3 receptor at Inks Lake shows exceedances of the %HA threshold for construction and operations. Sound levels at the TLU9 receptor at Jacko Lake prayer tree substantially exceed the %HA threshold during piling activity, and less so during operations. KAM has suggested specific mitigation measures at these sites, however, the Agency and EAO question if the proposed measures would be sufficient to reduce the effect below the %HA threshold. As such, the Agency and EAO anticipate a residual noise effect at the TLU 3 and TLU 9 receptors. The Agency and EAO considered the effects of noise in relation to effects of changes to the environment on current use of lands and resources for traditional purposes (section 18).

Overall, within the local study area level (receptors #21, TLU3 and TLU9 notwithstanding), the Agency and EAO anticipate that noise effects would be audible (at times) throughout the local study area, would diminish with distance from the source, and would cease upon decommissioning and closure. The Agency and EAO consider the likelihood of effects as low as mitigation is expected to be effective in addressing noise impacts in general (except for the two TLU sites, which would have a medium likelihood of effect). The Agency and EAO are moderately confident in this assessment noting that although the assessment methods and results are considered technically sound, the assumptions built into the modelled noise scenarios may not accurately reflect actual construction and operation noise emissions.

Effects of Ajax noise emissions are considered further as part of the EAO's assessment of impacts to property in section 16.

The Agency and EAO acknowledge sleep disturbance due to mine related noise is unlikely for most residential receptors. However, KAM's sleep disturbance assessment states that modelled outdoor noise levels at receptors #8 and #9 exceed the WHO 2009 thresholds before mitigation suggesting that resident's sleep at these locations has the potential to be disrupted should mitigation measures at these locations be ineffective. The Agency and EAO acknowledge that mitigation measures may reduce these exceedances below the WHO 2009 threshold for receptor #9. Following the application of visual back-up alarms on haul trucks and dispatch protocols that reduce vehicle congestion, an exceedance of 0.2 dBA over the 56 dBA threshold at receptor #8 remained. To safeguard against non-compliance with the WHO (2009) noise thresholds the EAO would impose EA Certificate conditions that requires noise and vibration management and monitoring plans. Overall, the Agency and EAO anticipate residual noise effects that impact sleep at this receptor and, to a lesser extent, the residences on the periphery of the project footprint. Section 10 of the health assessment concludes on the significance of this residual health effect.

The Agency and EAO recognize that people vary greatly in their sensitivity to noise and that certain noise sensitive people may be disrupted or annoyed regardless of whether an audible noise is below a regulatory threshold. It is possible, particularly under certain atmospheric conditions that mine related noise events could result in noise complaints to KAM from affected individuals. The Agency and EAO is supportive of KAM's commitment to establishing a formal complaints process to address noise and other mine activity issues if and when they arise. To help ensure noise complaints are addressed by KAM, the EAO proposes an EA Certificate condition which would require KAM to develop a formal process to receive and address public concerns, including related to noise issues. In consideration of the proposed mitigations and EA Certificate conditions, the Agency and EAO are of the view that noise events that precipitate complaints from affected members of the public would be adequately addressed.

Noise emissions associated with mine activities at night would result in a negligible or low magnitude sleep disturbance effect for residents within the Kamloops City limits including Knutsford. The magnitude of potential sleep disturbance is considered medium for those residences at or near receptor #8. The frequency of sleep disturbance will be contingent on the phase and daily operations of the mine. Overall nighttime noise effects would be audible (at times) throughout the local study area, would diminish with increasing distance from the source, and would cease upon decommissioning and closure.

The likelihood of effects is low considering that the WHO Sleep Disturbance guidelines are conservative and the exceedances at the rural residence receptors are minimal. For more urban properties mitigation is expected to be effective in addressing night time noise impacts in general.

The Agency and EAO's characterization of the residual effects of Ajax on noise and vibration, as well as the level of confidence in the effects determination of the potential residual effects, are summarized in Appendix A.

9.4.1 CUMULATIVE EFFECTS

The Agency and EAO are of the view that present and future projects and activities, including noise related to city expansion, forestry, agriculture, ranching, hunting and fishing, the Kamloops airport, as well as local and regional traffic on major and secondary highways, could contribute to cumulative noise effects in the local and regional study areas. Contributions from present activities were measured by KAM in its description of baseline conditions. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual effects discussed above.

The Agency and EAO are of the view that future growth and expansion of the City of Kamloops and future road development could potentially add to the baseline noise levels. The additive effect of future noises, including more continuous noise from highways, in combination with the more sporadic residual noise effects of Ajax, could result in a cumulative effect to the baseline sound levels for residences which are overlapped by these noise sources. The Agency and EAO are of the opinion that the cumulative effect would be low in magnitude, since the cumulative sound levels are expected to remain near current baseline.

9.4.2 CONCLUSION

The Agency and EAO evaluated changes to noise and vibration as a pathway valued component. Changes in noise and vibration have the potential to affect ecological, social, and economic values, as well as human health, which are the ultimate receptors. The results of the noise and vibration assessment inform the assessment and the significance determinations for the following valued component assessments: Fish and Fish Habitat (section

4), Wildlife (section 6), Human Health (section 10), Land and Resource Use (section 15), Property Values (section 16), and Current Use of Lands and Resources for Traditional Purposes (section 18).

10 Human Health

10.1 BACKGROUND

This section provides a summary of potential effects of Ajax on human health as identified by KAM, the mitigation measures proposed by KAM to address those effects, and a discussion of the key human health issues raised during the EA. It also sets out the analysis and conclusions of the Agency and EAO regarding Ajax's potential adverse effects to human health.

The assessment of potential effects to human health incorporates information from the assessments of project effects to Surface Water Quality and Quantity (section 2), Groundwater Quality and Quantity (section 3), Air Quality (section 8), Fish and Fish Habitat (section 4), and Noise and Vibration (section 9). Social inputs to health were assessed through Community Well-Being (section 11).

The evaluation of Ajax impacts to human health considers exposure through inhalation of contaminants in air, and through direct contact by ingestion of soil, country foods and drinking water, or with skin (dermal contact). This section also considers effects of noise and vibration on human health.

10.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

10.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

KAM identified that project components are located within 2 km of the closest residential area in the City of Kamloops, the neighbourhood of Aberdeen which is northeast of Ajax. The neighbourhoods of Sahali, West End/Downtown, North Shore and Brocklehurst are located north of Aberdeen. The agricultural area of Knutsford and several ranching residences are within 1 km of the boundary of the Ajax footprint. Kamloops Indian Reserve No. 1 is adjacent to the City of Kamloops. The local study area for human health is the same as that for air quality, and includes all of these neighbourhoods, agricultural areas, and part of Kamloops Indian Reserve No. 1.

Areas near the mine site, including Jacko Lake, are used by the public for recreational purposes, such as hunting and fishing. The SSN spring trout fishery is located at the outlet of Jacko Lake, which flows into Peterson Creek. Jacko Lake and the surrounding area is a cultural keystone area for SSN used for hunting, gathering, and ceremonial purposes. Residents of Knutsford carry out agricultural and ranching activities near the mine site.

KAM conducted baseline trace metal analyses for soil, groundwater, surface water, and country foods. Country foods are defined as those that may be produced in an agricultural (non-commercial) or backyard setting or harvested through hunting, gathering or fishing activities. KAM also modelled baseline concentrations of COPCs in air, and collected baseline air quality data through local monitoring stations. Based on its analysis, KAM stated that baseline concentrations of metals in air were negligible. Thus, particulate-bound metals resulting from Ajax would add to these negligible baseline concentrations.

The Kamloops region occasionally experiences periods of elevated particulate matter where air quality objectives are exceeded. The 24-hour average $PM_{2.5}$ concentration measured in West End/Downtown is slightly higher than the BC Ambient Air Quality Objective. In the North Shore, the measured 24-hour average $PM_{2.5}$ concentration is slightly below this objective and the 24-hour average PM_{10} concentration is above the BC Ambient Air Quality Objective.

Baseline metal levels in Jacko Lake are typically below BC's Approved Water Quality Guidelines for Aquatic Life. KAM observed exceedances of these guidelines in Peterson, Keynes and Humphrey Creeks for aluminum, copper and iron during freshet, and for manganese, molybdenum and selenium during low flows. KAM also observed exceedances of selenium in Jacko Lake.

Baseline metal levels in soil were above the MOE or Canadian Council of Ministers of the Environment Soil Quality Guidelines for aluminum, chromium and manganese.

Baseline surface water quality, groundwater quality, and air quality are described in sections 2, 3 and 8 respectively.

10.2.2 KAM'S ASSESSMENT OF ENVIRONMENTAL EFFECTS AND MITIGATION

Human health may be impacted by exposure to COPCs released by Ajax to the air, water and soil. KAM conducted a Human Health Risk Assessment (HHRA) to assess project-related health risks for nearby receptors, including residents of the City of Kamloops and inhabitants of Kamloops Indian Reserve No. 1. The HHRA compares the predicted changes in health risk between baseline and application case conditions to health risk acceptability benchmarks set by health authorities to be protective of human health.

KAM's predictive air dispersion and deposition modelling and water quality modelling informed the HHRA predictions. The baseline cases consider existing concentrations of COPCs in existing media. The project-alone cases consider COPCs generated only by Ajax and the corresponding health risk, whereas the application cases consider the project-alone case plus the baseline COPC levels and the corresponding health risk.

The HHRA considered potential health risks in relation to sensitive members of the population, who would be more susceptible to health effects associated with exposure to COPCs than the general population. Sensitive members of the population are generally considered to be children, pregnant women and the elderly. For inhalation exposures, sensitive members of the population include those with asthma and/or chronic obstructive pulmonary disease.

To assess health risk, HHRAs compare predicted chemical exposures to toxicity reference values (TRVs). TRVs represent the amount of a substance below which adverse effects are not expected to be observed in a population. For non-carcinogens in air, the ratio of the predicted exposure to the non-carcinogenic TRV is called the concentration ratio (CR). For non-carcinogens that are ingested, this ratio is called the hazard quotient. For carcinogens, the TRV is represented by the Incremental Increase in Lifetime Cancer Risk (IILCR), which is the threshold below which there is a negligible risk of any increase in cancers beyond the expected rates. An IILCR of 0.00001, often represented as 10^{-5} or 1E-5, is commonly used per the requirements of federal and provincial regulators. The human health TRVs are defined by regulatory agencies such as HC or US Environmental Protection Agency.

A CR or hazard quotient (HQ) less than 1.0 indicates the total exposure to a contaminant of potential concern is less than the health based guideline when every possible source of exposure is included in the estimated COPC concentration. HC's guidance for contaminated sites suggests a ratio of 0.2 should be applied as the threshold when some sources are missing from the estimate (for example, when background levels are not considered). KAM applied a risk benchmark of 0.2 in instances when some background sources were not included in estimated concentrations. A CR or HQ greater than 0.2 or 1.0 does not necessarily mean health impacts would occur, but signals that careful consideration of potential for health effects may be warranted.

The HHRA focused on assessing health risks in locations most likely to be affected by Ajax: upper Aberdeen, the community of Knutsford, and recreational areas surrounding Ajax. It also considered impacts for the neighbourhoods of Sahali, West End Downtown, North Shore, Brocklehurst and the property boundary, which is the location with the highest predicted ground-level COPC concentrations. KAM modelled COPCs at a number of locations important to sensitive members of the population, including schools, medical treatment facilities, daycares, and retirement homes.

Air

COPCs in air resulting from Ajax that may impact health include SO_2, NO_2, CO, $PM_{2.5}$, PM_{10}, polycyclic aromatic hydrocarbons (PAHs), and particulate-bound metals. KAM considers $PM_{2.5}$ representative of health risks resulting from particulate matter because $PM_{2.5}$ can be inhaled deep into the lungs and contribute to cardiovascular and respiratory disease. Nevertheless, KAM evaluated health risks associated with PM_{10} in the HHRA.

KAM identified the following particulate-bound metals for assessment of health risks: aluminum, antimony, arsenic, chromium, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, selenium, thallium and uranium. Particulate-bound arsenic, chromium and nickel are carcinogenic when inhaled.

KAM identified dust from unpaved haul roads as one of the primary sources of particulate matter for Ajax. In addition to inhalation risk, air emissions could result in deposition of metal-bearing dust to soil and water, which could increase metal concentrations in country foods and drinking water. These potential effects are considered with the direct contact exposure risks outlined below.

NO_2, SO_2, CO, and PAH Inhalation Risks

Combustion during mine operations will generate NO_2, SO_2, CO and PAHs. KAM's HHRA predicted the 1-hour SO_2 concentrations, 1-hour and annual average NO_2 concentrations, and 8-hour CO concentrations would be below the applicable toxicity reference values (also known as human health-based ambient air quality objectives). As the corresponding CRs for these COPCs were below 1.0, KAM concluded that the increase in NO_2, SO_2, and CO released by Ajax would represent a negligible human health risk.

For PAHs resulting from diesel combustion, KAM predicted IILCR for background levels combined with the project-alone contribution would be below the 1E-5 cancer risk benchmark for all receptor locations. As a result, KAM concluded that Ajax would result in a negligible health risk in relation to inhalation of PAHs.

Particulate Matter Inhalation Risks

The predicted $PM_{2.5}$ and PM_{10} concentrations based on a range of dust mitigation scenarios are presented in the Air Quality section (section 8).

The HHRA included a CR of 1.0 (with the 24-hour BC Ambient Air Quality Objective of 25 $\mu g/m^3$ as the TRV) as the $PM_{2.5}$ risk benchmark for the application case (project plus background) because KAM's view is that the HHRA considered all potential sources of $PM_{2.5}$ for local receptors. For the project-alone case, KAM applied a CR of 0.2 as the risk benchmark, which represents a concentration of 5 $\mu g/m^3$. Based on the 24-hour global/regional background value of 5.3 $\mu g/m^3$, KAM stated that the calculated CR for background $PM_{2.5}$ levels at the Project footprint exceeded 0.2.

KAM noted the HHRA showed that the project-alone CRs for $PM_{2.5}$ exceed 0.2, to a maximum of 0.6, on an infrequent basis for the dust mitigation scenarios in upper Aberdeen. Exceedance of the 0.2 risk benchmark occurs more frequently and at more of the receptor locations in upper Aberdeen with decreasing mitigation efficiency for haul road dust: 1 day per year and 3 receptor locations for the 90% scenario, 9 days per year and 6 receptor locations for the 80% scenario and 20 days per year and 8 receptor locations for the 70% scenario. For the 0% mitigation scenario, the project-alone CRs exceed 0.2 for 84 days per year at all receptor locations in upper Aberdeen. KAM observed that predicted $PM_{2.5}$ concentrations and corresponding CRs decrease with increasing distance from Ajax for the project-alone case.

KAM's HHRA predicted 24-hour $PM_{2.5}$ concentrations would not exceed the BC Ambient Air Quality Objective of 25 $\mu g/m^3$ (i.e., a CR of 1.0) for the application case at any of the receptor locations in upper Aberdeen for the dust mitigation scenarios, with the exception of the 0% scenario. For the 0% mitigation scenario, the predicted CR exceeds 1.0, to a maximum of 1.93, at the six receptor locations in upper Aberdeen closest to Ajax.

KAM's view is that 0% mitigation for dust from haul roads would be a temporary and highly unlikely event, and that the concentrations predicted under this scenario are not feasible. KAM indicated that a water truck would always be available to water haul roads, which would greatly reduce the possibility for complete failure of dust mitigation.

KAM concluded that $PM_{2.5}$ resulting from Ajax would result in a negligible increase in health risk to residents of upper Aberdeen because the application case CRs for 24-hour average $PM_{2.5}$ concentrations do not exceed 1.0 for the haul road dust mitigation scenarios, with the exception of the unlikely 0% scenario.

For PM_{10}, KAM's HHRA predicted that PM_{10} would exceed the 24-hour BC Ambient Air Quality Objective (50$\mu g/m^3$) in upper Aberdeen for the dust mitigation scenarios, with concentrations reaching as high as 586.9 $\mu g/m^3$ in the absence of mitigation. The CRs exceed 1.0 for the 24-hour averaging period 7 and 10 days per year during the winter under the 90% and 80% dust mitigation scenarios respectively. With 70% haul road dust mitigation efficiency, the HHRA predicted that the objective would be exceeded up to 21 days per year. KAM stated that PM_{10} would represent a negligible human health risk in upper Aberdeen because Ajax's contribution to PM_{10} levels would be minor.

KAM stated that human health risks related to $PM_{2.5}$ and PM_{10} may occur in the absence of mitigation to control dust from project activities. KAM concluded that mitigation measures proposed for air quality (section 8), which were reflected in the predicted concentrations in the HHRA, would be sufficient to mitigate impacts to human health. These mitigation measures include minimizing material drop heights, watering road surfaces and applying dust suppressants, covering the conveyor from crusher to plant, and covering ore stockpiles.

Particulate Bound Metals Inhalation Risks

Waste rock, ore and tailings dust are the primary sources of particulate-bound metals in air resulting from Ajax. KAM's HHRA concluded that the non-cancer risk benchmark of 0.2 is not exceeded by the CRs for particulate-bound metals in air for the application case. Similarly, the cancer risk benchmark of 1E-5 is not exceeded by the IILCRs for arsenic, chromium and nickel in air for the application case. As a result, KAM concluded that Ajax would result in a negligible increase in health risk from the inhalation of particulate-bound metals.

Direct Contact Exposure Risks

Metal concentrations in soil would increase over the life of Ajax due to the deposition of metal-bearing dust, which could result in increased exposure through direct contact. The direct contact exposure pathway includes exposure to metals through incidental ingestion of soil, dermal contact with soil, and consumption of country foods. KAM also assessed direct contact health risks relating to exposure to increased Ajax-related metals through consumption of drinking water, fish, cattle and wild meat.

KAM's HHRA estimated the direct contact cancer and non-cancer health risk for all age groups, including toddlers and adults, with consideration of the haul road dust mitigation scenarios. The toddler results were presented alongside the adult results in the HHRA, as the toddler is generally the most sensitive receptor. For both toddler and adult receptors, KAM applied HQ benchmarks of 0.2 and 1.0 for metals. KAM estimated that the HQs for total direct contact are below 1.0 for each metal at all receptor locations for toddlers and adults.

KAM predicted that HQs for some metals (aluminum, arsenic, cobalt, lead, selenium and thallium) would exceed 0.2 at some of the receptor locations under some or all of the dust mitigation scenarios for total non-cancer direct contact health risk for toddlers. KAM stated that the HQs for these metals exceed 0.2 for the baseline case, and are less than 0.2 for all project-alone cases. Health Canada's guidance[46] states that an exceedance of a human health-based toxicity reference value does not mean that health risks are unacceptable or will occur, but may warrant further consideration. KAM anticipated a negligible increase in health risk from direct contact to total metals for toddlers because Ajax contribution results in HQs less than 0.2 for all metals.

For adult receptors, KAM predicted that HQs were below 0.2 for all metals for non-cancer health risk, except arsenic (at Knutsford). KAM noted that the HQ for the project-alone case for arsenic at Knutsford is less than 0.2. KAM anticipated a negligible increase in health risk from direct contact to total metals for adults because the contribution from Ajax results in HQs less than 0.2 for all metals.

Of the metals identified as COPCs by KAM, arsenic is the only one that is carcinogenic when ingested. KAM recognized that the baseline level of arsenic in groundwater (0.00093 mg/L) could result in an overall lifetime cancer risk for residents of Knutsford that is approximately three times higher than the negligible risk level of 1E-5. KAM estimated that Ajax would result in an increase in arsenic concentrations from 0.00093 mg/L to 0.0056 mg/L in groundwater. This predicted concentration is below the Canadian Drinking Water Quality Guideline value of 0.010 mg/L for arsenic, which means residents of Knutsford would not be subject to lifetime cancer risks higher than residents of other Canadian communities relying on potable water with baseline arsenic levels higher than the negligible risk concentration established by HC.

Based on the results of the HHRA, KAM predicted that measures identified to mitigate air and dust emissions and surface and groundwater discharges identified in Surface Water Quality and Quantity and Groundwater Quality and Quantity (sections 2 and 3) and Air Quality (section 8) will mitigate emissions of COPCs to a level that is protective of human health. As such, KAM has not identified additional mitigation measures specifically for health effects.

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[46] HC, 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0.

Noise and Vibration

KAM evaluated potential health effects of noise in relation to the OGC's British Columbia Noise Control Best Practices Guideline (2009), HC's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (2017), and the WHO's Night Noise Guidelines for Europe (2009). KAM noted that, prior to mitigation, all modelled noise impacts were below applicable regulatory thresholds for daytime noise with three exceptions: noise resulting from pile driving at three receptors (one residential and two traditional use sites) would exceed the 6.5% highly annoyed noise threshold from HC's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (2017). KAM predicted that, prior to mitigation, the sleep disturbance threshold in the WHO's 2009 Night Noise Guidelines would be exceeded at two residential receptors near the mine footprint. KAM noted that vibration levels at all residential receptors are below human annoyance thresholds.

KAM identified the following mitigations to reduce the potential for annoyance and sleep disturbance:

- Use of radio communication instead of a warning horn at night in areas where noise exceedances may occur;
- Use of non-tonal (or visual) type backup alarms for mobile equipment;
- Utilize a mobile dispatch system to minimize equipment congestion; and
- Review and calibrate performance of equipment dispatch software to limit equipment congestion in sensitive areas for noise.

10.2.3 KAM'S CONCLUSIONS ON RESIDUAL EFFECTS

KAM concluded that Ajax would result in a negligible increase in health risk for nearby receptors in the City of Kamloops, Kamloops Indian Reserve #1, and the community of Knutsford for inhalation or direct contact exposure to COPCs.

KAM acknowledged that health risk could increase due to exposure to $PM_{2.5}$ and PM_{10} if mitigation measures were not in place to minimize dust emissions. KAM committed to minimizing dust emissions through the mitigation measures identified in the Fugitive Dust Management Plan.

KAM concluded that noise related impacts to health are unlikely assuming that mitigations for noise emissions that could lead to sleep disturbance during operations are effective. Vibration effects are not expected to result in any health impacts at any time. KAM's noise and vibration assessment is summarized in section 9 of the Report.

10.2.4 CUMULATIVE ENVIRONMENTAL EFFECTS

KAM noted effects of past or present projects were accounted for in the baseline levels established for COPCs and noise. KAM did not identify any reasonably foreseeable future projects and activities that may contribute COPCs to air or water. For these reasons, KAM does not anticipate any cumulative environmental effects relating to health risks associated with COPCs. KAM's assessment of cumulative noise and vibration effects identified the

TMX project as interacting with Ajax. KAM does not anticipate any cumulative noise or vibration effects, as noise from nearby projects would attenuate to baseline levels outside the regional study area.

10.2.5 MONITORING AND FOLLOW-UP

Proposed monitoring and follow-up related to surface and groundwater (sections 2 and 3), air quality (section 8) fish (section 4) and noise and vibration (section 9) would be used to confirm effects predictions related to human health.

10.3 DISCUSSION OF ISSUES

During the review period, members of the working group and the public raised concerns related to the potential effects of Ajax on human health. This section provides a summary of the key issues raised and KAM's responses.

10.3.1 INCREASES IN $PM_{2.5}$ AND PM_{10}

HC, ECCC, SSN, and Interior Health Authority expressed concern that $PM_{2.5}$ levels would be higher than estimated in KAM's original HHRA if the proponent does not achieve 90% efficiency for mitigation of dust from haul roads. Members of the public were particularly concerned with the potential for increased $PM_{2.5}$ levels because there is no identified safe level below which health impacts are not expected. HC anticipated that lower levels of mitigation efficiency for haul road dust could result in substantial increases in $PM_{2.5}$ levels and a corresponding increase in measurable health effects. SSN expressed concern that KAM may have underestimated $PM_{2.5}$ emissions based on assumptions associated with the tailings beach area.

KAM responded by revising the HHRA to reduce the uncertainty relating to potential $PM_{2.5}$ levels and adjusting the area of the tailings beach to be more conservative for dispersion modelling purposes. The revised HHRA demonstrated that $PM_{2.5}$ levels increase with decreasing haul road dust mitigation efficiency.

MOE identified that high levels of PM_{10} would be possible in the short term if mitigation of dust is not as effective as predicted. It would be possible that project-related dust could contribute to a short term event that would be below the 24-hour Ambient Air Quality Objective and that would be noticeable and objectionable to nearby residents. High levels of PM_{10} in the short term could be a concern, even where the 24-hour objective is not exceeded, as nearby residents may experience difficulty breathing and eye irritation.

KAM's HHRA concentrated on 24-hour and annual statistics for $PM_{2.5}$ and PM_{10}, as these are the averaging periods on which Ambient Air Quality Objectives (AAQOs) are based. The AAQOs use these averaging periods because the link between air quality and health effects is based on studies which use daily and annual averaging periods. MOE noted there is currently not sufficient scientific evidence to support Ambient Air Quality Objectives for $PM_{2.5}$ and PM_{10} based on shorter averaging periods. This does not mean that there is not a health effect due to shorter periods of high concentrations, but that scientific studies are not yet available to evaluate these effects.

In response to concerns with potential $PM_{2.5}$ and PM_{10} increases, KAM updated the Dust Action Response Plan to include commitments to implement additional mitigation if trigger levels are approached or reached. KAM would monitor $PM_{2.5}$ and PM_{10} continuously at the existing upwind monitoring station on Stake Lake road and the existing downwind monitoring station in upper Aberdeen at Pacific Way Elementary School. The trigger levels KAM identified are based on measured differences between the concentrations at the downwind and upwind stations, which would provide confidence that differences in measurements between these stations could be attributed to Ajax.

Where $PM_{2.5}$ or PM_{10} concentrations approach the trigger level, KAM would monitor conditions hourly, cease non-essential activities in affected areas, and minimize the number and length of haul routes during dry conditions with high winds. When trigger levels are reached, KAM would implement a range of mitigative actions up to full cease of haul activity. KAM would resume operations once meteorological conditions have improved and concentrations are trending downwards, or the concentrations are attributed to a source other than Ajax.

10.3.2 CONCENTRATION RATIOS AND HAZARD QUOTIENTS

HC, IHA, and the City of Kamloops raised concerns that KAM's selection of CR and HQ benchmarks would need to be appropriate to adequately reflect health risks resulting from Ajax. HC highlighted the importance of assessing overall health risks that reflect levels of COPCs from Ajax combined with background levels (i.e., other sources of contaminants) rather than the project-alone case. An understanding of health risk has to consider background levels of COPCs, as applying guidelines or thresholds to individual sources may not be sufficient to protect human health. HC advised that interpretation of CRs and HQs less than a risk benchmark of 1.0 is appropriate for assessing health risk related to total exposure to COPCs. When some sources are not included, the estimated CR or HQ does not represent total exposure. HC's guidance for contaminated sites[47] therefore recommends a ratio of 0.2 when all sources are not included in the estimate. HC advised that a risk benchmark of 0.2 would be appropriate for $PM_{2.5}$ since indoor sources have not been included in the HHRA. HC also suggested application of a risk benchmark of 0.2 for ingestion exposures since some sources were not considered in the HHRA, such as locally produced dairy and retail foods and beverages.

KAM responded to HC's suggestions by applying a risk benchmark of 0.2 to for inhalation risk for $PM_{2.5}$ for the project-alone case and highlighted that the application case included background sources such as combustion traffic and fugitive dust. KAM responded by applying a risk benchmark of 0.2 for total direct contact exposures in the revised HHRA. The application of these risk benchmarks allowed the risk assessment to reflect that all background sources were not included with the assessment of the project-alone case.

If the baseline HQ or CR exceeds the decision threshold (i.e., >1, >0.2), HC does not support adding 0.2 to the baseline CR/HQ ratio to create a new decision threshold. The fact that the project-alone contribution has an HQ below the threshold (i.e., <1 or <0.2) is insufficient evidence on its own for establishing negligible health risk.

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[47] HC, 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0.

10.3.3 NON-THRESHOLD POLLUTANTS

HC noted that $PM_{2.5}$ and NO_2 are considered non-threshold pollutants, meaning that guidelines should not be interpreted as acceptable "pollute-up-to" levels, as population health effects could occur at levels below the guidelines. HC reiterated that under all assessed scenarios, Ajax is expected to increase concentrations of airborne $PM_{2.5}$, for which there is no recognized threshold below which health impacts are not expected. Health effects may be experienced at any level of exposure for non-threshold pollutants, although the risk measured at a population level decreases with decreasing concentrations. KAM acknowledged that $PM_{2.5}$ and NO_2 are non-threshold pollutants, and intends to minimize emissions of these COPCs to the extent practical.

10.3.4 MONITORING COPCS

HC observed that KAM predicts a CR of 0.78 at Jacko Lake for the maximum 98th percentile 1-hour NO_2 concentration, which is approaching the risk benchmark of 1.0. HC suggested monitoring of NO_2 in this area to verify model results, and implementation of mitigation measures if levels are higher than predicted. HC also suggested sampling tailings regularly for metals analysis, updating the HHRA if levels are higher than predicted, and implementing further mitigation for inhalation risks related to particulate-bound metals if warranted. Similarly, HC suggested regular monitoring of groundwater used for drinking water for arsenic, with mitigative actions implemented if levels are higher than anticipated.

KAM has committed to continuously monitor NO_2 at the existing upwind monitoring station on Stake Lake road and the existing downwind monitoring station in upper Aberdeen at Pacific Way Elementary School. KAM would establish the location for the NO_2 monitor through consultation with HC. Should KAM detect high levels of NO_2 resulting from blasting, access to Jacko Lake would be restricted until the NO_2 plume dissipates. KAM's groundwater monitoring plan would include monitoring for arsenic, the results of which would be included in a database, against which water quality modelling and HHRA predictions could be compared. KAM would undertake confirmatory sampling of tailings on a monthly basis to create a database against which HHRA predictions could be compared. Should levels of NO_2, metals in tailings, or arsenic in groundwater exceed those predicted in the HHRA, KAM would review the monitoring datasets in consultation with HC to determine if the changes in metals concentrations warrant a reassessment of the HHRA. KAM would implement further mitigation if appropriate.

10.3.5 COUNTRY FOODS CONSUMPTION

HC identified that bioaccumulation could result in the underestimation of metals concentrations in fish consumed as country foods. HC could not conclude that metals were not increasing with fish size for Rainbow trout from Jacko Lake based on the limited data provided by KAM. SSN and HC expressed concern that ingestion of COPCs could be underestimated if KAM underestimated country food consumption rates. The City of Kamloops, IHA, and HC were concerned that KAM had not provided a baseline consumption rate for country foods that considered consumption patterns, food preparation methods, and seasonal trends. HC suggested sampling of fish, of an appropriate size and species typically consumed, and local backyard produce for metals in accordance with accepted standards and guidance. HC suggested updates to the HHRA if levels are higher than predicted and consideration of additional mitigation depending on the results of the updated HHRA.

KAM has agreed to sample fish from Jacko Lake, annually for the first 5 years, and backyard produce for metals, annually for the first 5 years at locations consistent with the baseline program. Should levels of metals in fish or backyard produce exceed those predicted in the HHRA, KAM would review the monitoring datasets in consultation with HC to determine if the changes in metals concentrations warrant a reassessment of the HHRA. KAM would implement further mitigation if appropriate.

During the review period, SSN and the Kamloops Area Preservation Association identified a report[48] produced for Teck Resources that evaluated the build-up of metals on lichens due to dust deposition from the Highland Valley Copper mine, and requested that the findings of the report be considered in the Ajax EA. The study used dust deposition patterns (obtained from monitoring lichens) to assess the potential effects of fugitive mine dust on traditional plants harvested by the local Nlaka'pamux people. The study describes the benefits of using lichens to monitor the long-term build-up of metals from dust deposition, and suggests that soil sampling is not as reliable an approach due to the inherent variability in soil chemistry.

MOE noted that the report ground-truths the approach to using lichens for long-term monitoring of metals in dust in similar climatological and geographical conditions as Ajax. MOE indicated that the Highland Valley study presents an approach that could potentially be implemented to support a long-term monitoring strategy for Ajax, but stated that it would be inappropriate to apply the results of the Teck Resources study to Ajax because of the inherent design differences between the two mines.

10.3.6 HEALTH IMPACT ASSESSMENT

SSN and members of the public requested completion of a Health Impact Assessment to fully assess health risks related to Ajax. A Health Impact Assessment is a more comprehensive assessment than an HHRA, as it would consider social determinants of health and community perspectives in addition to the physical determinants of health considered in an HHRA. KAM clarified that the HHRA considers baseline exposure levels for COPCs, changes to these levels resulting from Ajax, and the exposure pathways.

The Agency and EAO note that HHRAs are an accepted approach to evaluate project-related health risks for EAs in Canada. KAM noted that their assessment of health effects considered factors that may also be found in health impact assessments, such as the social and economic considerations in the Health Living and Health Education and the Community Health and Well-Being valued components. KAM considered factors such as overall quality of life, impacts to housing availability and property values and loss of recreational activities through other valued components in addition to the physical determinants of health considered in the HHRA. KAM acknowledged that perceived effects can have real influence over behaviours and community well-being, and stated that they will endeavour to manage these impacts through transparency and information sharing.

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[48] Dust Mapping and Traditional Plant Study – Teck Highland Valley Copper Partnership. Integral Ecology Group; S. Berryman, K. Berg, A. Garibaldi, & J. Straker. March 10, 2016.

10.3.7 PUBLIC COMMENTS ON GENERAL HEALTH

Concern about human health was a major theme among comments received from the public and community groups, some of which included health professionals such as physicians. The public frequently raised concerns with effect of dust, noise, groundwater contamination, and tailings storage facility or slope failures on the health of residents of the Kamloops area. The public also raised concerns with potential health effects to vulnerable populations. The public consider increased cancer rates, increased incidence of asthma, and loss of life from major dam failures to be potential health impacts resulting from Ajax. In response to these concerns, KAM outlined the conclusions of the HHRA and their prediction that the health risk would be negligible. An assessment of impacts of accidents and malfunctions, including dam failures, is included in section 20.

10.3.8 NOISE AND VIBRATION

The City of Kamloops questioned the use of averages in KAM's noise and vibration assessment, as this approach masked the maximum noise levels that would allow for a more complete understanding of noise and vibration effects. In response, the EAO required KAM to conduct additional noise and vibration assessments to reduce uncertainty. KAM's additional vibration assessment conclusions were consistent with the EIS/Application. KAM's additional noise assessments showed that for the operation phase, two residential receptors (#8 and #9) exceeded the 56 dBA threshold for sleep disturbance prior to mitigation; a separate residential receptor (#21) north west of the mine footprint and traditional land use sites at Jacko Lake and Inks Lake exceeded HC's human annoyance thresholds (6.5 %HA) for daytime noise during pile driving (construction phase) prior to mitigation. KAM identified mitigation measures, such as use of non-tonal backup alarms on mobile equipment and noise dampening shields around the pile driver, and concluded these measures would bring noise levels at receptors #9 and #21 and the
2 traditional use sites below thresholds. Noise levels at receptor #8 (56.2 dBA) would remain slightly above the WHO sleep disturbance threshold of 56 dBA.

10.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

In consideration of KAM's proposed mitigation measures, and information received during the EA, the Agency and EAO are of the view that Ajax would result in the following residual effects to health:

- Increased health risk associated with inhalation of COPCs, including non-threshold contaminants such as $PM_{2.5}$, PM_{10} and NO_2;
- Increased health risk associated with direct contact exposure to metals; and
- Increased noise that may disrupt or annoy residents in close proximity to the mine site during the day time with the potential to disrupt the sleep of residents at night.

10.4.1 INHALATION HEALTH RISKS

The Agency and EAO are of the view that mitigation of dust will be key to minimizing health risks resulting from $PM_{2.5}$ and PM_{10}, as concentrations increase with decreasing mitigation efficiency for haul road dust. In consideration of technical advice from MOE, the Agency and EAO generally agree with KAM's commitment to monitor $PM_{2.5}$ and PM_{10} upwind and downwind of the mine site to allow for detection of increases in total suspended particulate attributed to Ajax. Should trigger levels be approached or reached, KAM would implement a range of mitigation measures up to full cease of haul activity. While the Agency and EAO acknowledge there is uncertainty relating to efficiency of mitigation measures for haul road dust (a primary source of $PM_{2.5}$ and PM_{10}), KAM's Dust Action Response Plan, as part of the Fugitive Dust Management Plan, provides for timely implementation of mitigation in the event $PM_{2.5}$ and PM_{10} levels approach trigger levels.

The Agency and EAO acknowledge that health risk increases with increases in $PM_{2.5}$, even when concentrations are below guideline levels; therefore, an understanding of total exposure to $PM_{2.5}$ is important in assessing health risks. In relation to total exposure, KAM predicted that a CR of 1.0 (the $PM_{2.5}$ risk benchmark for the Ajax plus background case) will not be exceeded in upper Aberdeen, unless mitigation fails completely, in which case mitigative actions based on KAM's Fugitive Dust Management Plan would be implemented.

The Agency and EAO recognize that Ajax would contribute to PM_{10} levels exceeding BC Ambient Air Quality Objectives occasionally. These exceedances would increase in frequency and magnitude with decreasing efficiency of haul road dust mitigation levels. Predicted PM_{10} levels in particular increase substantially with decreasing mitigation efficiency for haul road dust. High levels of PM_{10} could result in health impacts, such as difficulty breathing and eye irritation.

The Agency and EAO are of the view that KAM's Fugitive Dust Management Plan would address gradual increases in $PM_{2.5}$ and PM_{10} that are typical during winter conditions; however, this plan would be less effective at mitigating short-term spikes that could occur under dry and windy conditions. While scientific studies are not yet available to support Ambient Air Quality Objectives for $PM_{2.5}$ and PM_{10} based on shorter averaging periods, the Agency and EAO acknowledge that this does not mean that there is not a health effect due to shorter periods of high concentrations. Dust mitigation measures, such as watering haul roads and applying dust suppressants would be particularly important during dry and windy periods. While Ajax would contribute $PM_{2.5}$ and PM_{10} to the atmosphere, the Agency and EAO note that mitigation measures for $PM_{2.5}$ and PM_{10} identified by KAM are part of the EA Certificate conditions proposed by the EAO. Refer to section 8 of this Report for the Agency and EAO's assessment of effects to air quality, and discussion of related proposed EA Certificate conditions.

The Agency and EAO are of the view that the health risks for $PM_{2.5}$ and PM_{10} are medium in magnitude since concentrations differ, sometimes substantially, from the average value for baseline conditions. The frequency of dust exceedances would range from sporadic ($PM_{2.5}$) to regular (PM_{10}) throughout the life of Ajax, depending on mitigation efficiency and atmospheric conditions. Increased dust levels resulting from Ajax would be limited to the local study area and long-term in duration. The predicted effect would be irreversible because changes in health resulting from long term increased exposure to Ajax-related dust may persist once project activities cease. There is a high likelihood this effect would occur, since Ajax would result in emissions of $PM_{2.5}$ and PM_{10}.

The Agency and EAO acknowledge that Ajax would also result in an increase to SO_2, NO_2, CO, PAHs, and particulate-bound metals. The Agency and EAO are of the view that inhalation health risks for these COPCs from Ajax would be low in magnitude, as the toxicity reference values are not exceeded. The effect for these COPCs would be long-term in duration, sporadic (particulate-bound metals) to continuous (SO_2, NO_2, CO and PAHs), limited to the local study area and irreversible for NO_2. There is a high likelihood this effect would occur, since Ajax would result in emissions of NO_2, SO_2, CO, particulate-bound metals and PAHs

The Agency and EAO accept HC's suggestion that NO_2 levels should be monitored, as the predicted levels approach the toxicity reference value (i.e., 1-hour average BC Ambient Air Quality Objective of 188 µg/m3), and

NO_2 is a non-threshold pollutant. KAM has agreed to monitor NO_2 levels continuously at the existing upwind monitoring station on Stake Lake road and the existing downwind monitoring station in upper Aberdeen at Pacific Way Elementary School, and would review monitoring results in consultation with HC if levels are higher than predicted to determine whether the HHRA should be updated. KAM has also agreed to sample tailings for metals concentrations (i.e., particulate-bound metals) in response to HC's sampling recommendation. KAM would review monitoring results in consultation with HC if levels are higher than predicted to determine whether the HHRA should be updated. The Agency and EAO note KAM would implement additional mitigation measures to address exposure to NO_2 and particulate-bound metals in consultation with HC, ECCC, and MOE, if appropriate.

10.4.2 *DIRECT CONTACT*

Because it is important to assess overall risks for the protection of human health, the Agency and EAO considered the aggregate effect of all direct contact exposure pathways (including incidental ingestion of soil, dermal contact with soil, and consumption of country foods and drinking water) in assessing the total direct contact health risk.

The Agency and EAO agree that KAM has adequately assessed Ajax's contribution of metals through direct contact exposure in relation to the dust mitigation scenarios. The Agency and EAO anticipate that increases in metal exposure through direct contact would result in a low to medium magnitude effect, as the HQ is below the risk benchmark of 0.2 or the exceedance does not substantially exceed the benchmark. The predicted effect would be far future in duration, since any metals released to the environment would remain in perpetuity. The effect would be continuous and irreversible since metals will persist in the environment, and the effect would be limited to the local study area. There is a high likelihood the effect would occur, since Ajax would contribute metals to the environment. KAM would mitigate dust emissions to minimize metal exposure through direct contact.

The Agency and EAO agree with HC's suggestion that KAM monitor arsenic levels in groundwater (noting that it is elevated in the base case scenario) and sample fish and country foods for metals. While mercury has been identified in fish in Jacko Lake, such that the baseline HQ for the Indigenous toddler is above 0.2 (i.e., 0.245), KAM's HHRA predicts that Ajax would not result in an increase in mercury in fish in Jacko Lake. KAM has agreed to sample groundwater and fish tissue, and would review monitoring results in consultation with HC if levels are higher than predicted to determine whether the HHRA should be updated. The Agency and EAO note KAM would implement additional mitigation measures if appropriate.

10.4.3 *NOISE AND VIBRATION*

The Agency and EAO acknowledge that noise effects, such as annoyance in humans during the day and sleep disturbance at night due to mine related noise, are unlikely to occur for most residential receptors. However, the Agency and EAO note that modelled outdoor noise levels at two rural residential receptors could exceed the WHO 2009 thresholds before mitigation, suggesting that residents' sleep at these locations has the potential to be disrupted should mitigation measures at these locations be ineffective. From a precautionary perspective, the Agency and EAO would add that other residences which are near receptor #8 could also have their sleep disturbed. The Agency and EAO acknowledge KAM's planned mitigations to reduce noise emissions below guidelines thresholds. To help ensure that potential impacts to health as a result of noise emissions are minimized, the EAO proposes EA Certificate conditions requiring noise and vibration management and monitoring plans.

Additional analysis of noise and vibration including proposed EA Certificate conditions to address residual effects are in section 9 of the Report.

In consideration of the proposed mitigation and EA Certificate conditions, the Agency and EAO find that noise emissions associated with mine activities at night would result in a negligible magnitude sleep disturbance effect for residents within the Kamloops city limits, including Knutsford, as the modelled noise levels, on average, are at or below the measured baseline. The magnitude of potential sleep disturbance is considered medium for rural residences near the location of the proposed tailings storage facility, which is outside the Kamloops city limits, as noise could exceed the sleep disturbance threshold at this location. Overall, nighttime noise would be audible (at times) throughout the local study area, would diminish with increasing distance from the source, and would cease upon decommissioning and closure. The Agency and EAO consider the likelihood of health effects due to noise as low, acknowledging that the WHO Sleep Disturbance guidelines are conservative and the exceedances at the rural residence receptors are minimal.

10.4.4 CHARACTERIZATION OF RESIDUAL EFFECTS AFTER MITIGATION

The Agency and EAO find that that there would be residual human health effects because of increase in COPCs and noise emitted by Ajax. The magnitude of the health effects would be negligible (sleep disturbance for residents within Kamloops city limits), low (inhalation of NO_2, SO_2, CO, PAHs, and particulate bound metals), or medium (inhalation of $PM_{2.5}$ and PM_{10},direct contact metals exposure, and sleep disturbance for residents near the proposed tailings storage facility). Effects would be long-term (air) to far-future (soil), as increased concentrations in air would last at least the duration of Ajax and metals in soils would persist. Sleep disturbance effects would last throughout operations (medium-term). Dust exceedances would be sporadic ($PM_{2.5}$ and particulate-bound metals) or regular (PM_{10}) based on the frequency of predicted exceedances of air quality objectives. Exposure to other COPCs would be continuous (NO_2, SO_2, CO, PAHs and direct contact metal exposure) as emissions would be generated consistently throughout the life of Ajax and metals would persist in soil. Sleep disturbance would be sporadic based on the location and frequency of haul road traffic. Effects of increased dust and NO_2 exposure by inhalation and direct contact exposure to metals would be irreversible. Effects of noise and vibration would be reversible. The effects would be limited to the local study area (local).

The Agency and EAO recognize that multiple sources of uncertainty related to the assessment of health effects have been identified, including uncertainty with efficacy of dust mitigation and reliance on modeling to characterize the baseline concentrations of COPCs in air. The Agency and EAO focused on identifying robust monitoring and a follow-up program that would allow for early detection of levels of COPCs, including dust, that vary from those predicted in the EA. This early detection and mitigation actions identified in the Fugitive Dust Management Plan would allow for actions to be taken in a timely fashion to address any potential health risks.

The Agency and EAO's characterization of the residual effects of Ajax on human health, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

10.4.5 CUMULATIVE EFFECTS

The Agency and EAO are of the view that past and present projects and activities, including development of the City of Kamloops and local industry, could contribute to cumulative effects on human health in the regional study area. Contributions from these past and present sources were captured by KAM in its description of baseline conditions. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual effects discussed above.

The Agency and EAO are of the view that the health assessment has not identified future projects that may increase COPC concentrations. The Agency and EAO are of the opinion that the cumulative effects for health are the same as the residual effects to health.

10.4.6 CONCLUSION

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to human health.

Taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to human health.

11 Community Well-being

11.1 BACKGROUND

The assessment presented in this section is made in consideration of a number of sections in KAM's EIS/Application: dark sky (section 8.2); visual impact and aesthetic features (section 8.3); healthy living and health education (section 10.6); and, community health and well-being (section 10.7). The EAO recognizes that 'community well-being' is a broad topic which typically would include considerations for environmental quality, recreation, employment, and a variety of other social and economic valued components. As many of these valued components are addressed individually and elsewhere in this report, the EAO has elected to assess community well-being through an evaluation of project effects on access to healthcare services, visual quality, and dark sky.

11.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

11.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

KAM identified education, income, social networks, physical environment, and individual factors such as genetics and personal practices as some of the components that contribute to community health and well-being.

Health care for the communities in the area, including the City of Kamloops is provided by the IHA. Healthcare services on-reserve are provided by the First Nations Health Authority. The EIS/Application states that healthcare services in Kamloops are currently experiencing a chronic shortage of family doctors and capacity issues at the Royal Inland Hospital. The Tk'emlúps te Secwépemc health centre is currently without a doctor, and its part-time nurse practitioner cannot always meet the demand.

Regarding current dark sky conditions, the EIS/Application noted that the Ajax location is largely rural and there are no permanent outdoor light sources at the Ajax site. Neighbouring farms along Lac Le Jeune Road, Goose Lake Road, Long Lake Road, and Edith Lake Road use outdoor lighting systems and vary in distance to Ajax infrastructure from 0.73 km to more than 3 km. The nearest Kamloops residential light sources are the homes in Knutsford along Hwy 5A, which are located along Long Lake Road approximately 1.5 km from the Ajax site. The Stake Lake Observatory is located approximately 8.6 km southwest of the Ajax site.

Visual and aesthetic features contribute to sense of place and are a component of community well-being. The EIS/Application also considered the potential visual impacts of Ajax on views and sight lines from various locations including residential, recreational areas (including Jacko Lake), transportation routes (including the Coquihalla Highway, Lac Le Jeune Road, Highway 5, Highway 5A, Goose Lake Road, Long Lake Road, and Edith Lake Roads, etc.) and commercial areas.

11.2.2 POTENTIAL EFFECTS AND MITIGATION MEASURES

The EIS/Application states that education programs encouraging healthy living lifestyles for workers will have a beneficial effect during all project phases in terms of promoting health education, and will also have a beneficial effect on healthy living for workers and their families. In addition, it was discussed that community health and well-being were not expected to be adversely affected from biophysical changes caused by Ajax. The EIS/Application reports that Ajax could affect community health and well-being as a result of:

- Increased project-related traffic during construction, which could lead to increased collisions on public roads;
- The presence of a temporary and non-local construction workforce which would likely interact with the local community; and
- The availability of disposable income, which can lead to socially irresponsible or reckless behaviours and thereby increase demands on policing and healthcare services.

The EIS/Application also reported that healthcare services in Kamloops face pressures from the existing population and this would be expected to increase during construction and possibly operations with the influx of workers and their families.

The EIS/Application included an assessment of the potential impacts of Ajax on the dark sky valued component, which was included due to real or perceived effects related to "obtrusive" artificial light at night from project components. According to the EIS/Application, obtrusive light extends beyond the intended area and can be classified as spill light, glare, or sky glow.

While night-time construction activities are not planned, there could occasionally be a need to continue construction into the evening or night, or when days are short or light levels are low. During these times, KAM states that lighting would be required for worker safety. During project operations, the process plant would operate 24 hours per day requiring continuous illumination. Buildings, access roads, haul roads, bridges and other work areas would also need appropriate illumination as required by WorkSafe BC. Decommissioning and closure activities would primarily take place during daylight hours.

Spill light and glare have the potential to affect an area several hundred metres beyond the target area. Topography and vegetation form natural barriers which would reduce the extent of the effect. According to the EIS/Application, the highest potential for spill light or glare would be along the Coquihalla Highway, Lac Le Jeune Road, and at Jacko Lake. Sky glow is not typically influenced by topography and its extent can be perceived much further than spill light and glare. KAM reports that the area potentially affected by sky glow would extend up to 5 km from the boundaries of Ajax.

KAM assessed potential effects related to visual quality at 39 viewpoints associated with residences, roads, and recreation sites as identified with input from the City of Kamloops and MFLNR using a viewshed analysis and related visual simulations. The EIS/Application stated there would be a substantial degree of change[49] from current conditions, after mitigation is applied, for the viewpoint from Edith Lake Road; while a moderate degree of change[50] from current conditions to viewpoints from Long Lake Road, Goose Lake Road, Jacko Lake, Lac Le Jeune Road and Coal Hill. All other viewpoints were considered to have negligible to slight effects.[51]

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[49] As defined in the Hassell Matric Analysis in the EIS/Application section 8.3

11.2.3 PROPOSED MITIGATION MEASURES

In the EIS/Application, KAM identified the following key proposed mitigation measures to address potential adverse effects to community health and well-being, dark sky, and visual quality:

- Provision of a dedicated general practitioner during the construction phase to provide basic healthcare services for the workforce;
- Establishment of a Community Liaison Group (CLG) to improve and support collaboration, dialogue, and understanding between KAM and the community and to provide a forum to discuss issues and additional mitigation measures (as may be required) to community well-being issues resulting from construction and operations;
- Implementation of social and economic monitoring plans to help monitor and maintain the community image and residents' perceived quality of life;
- Implementation of a Community Investment Program promoting community wellbeing;
- Implementation of a Traffic Management Plan to reduce impacts traffic volumes and maintain safe roadways;
- Implementation of a lighting mitigation and management plan which would establish illumination management techniques, shielded and directed lighting, and spectral control
- Siting of infrastructure at the mine site to reduce visual disturbance;
- Progressively reclaiming and vegetating disturbed areas throughout the life of Ajax to reduce visual impacts;
- Using good visual design principles to help project components and infrastructure blend into the landscape, such as colour and use of vegetation to screen; and
- Engagement with individual landowners whose properties may be affected by changes to visual quality.

11.2.4 CUMULATIVE EFFECTS

With respect to dark sky and visual quality, KAM identified future residential development in south west Kamloops and the TMX as two projects that may result in cumulative effects to Ajax. KAM concluded that visual effects from access roads and future neighbourhood development are likely to result in noticeable cumulative effects with Ajax from the viewpoints studied.

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[50] Ibid.
[51] Ibid.

11.2.5 MONITORING AND FOLLOW-UP

KAM committed to continue their discussions with current landowners whose properties may be affected by changes to visual quality. KAM also noted that community concerns about visual quality could be discussed at the CLG forum.

11.3 DISCUSSION OF ISSUES

During the EA, the EAO received and reviewed comments from the public, SSN, and the working group.

11.3.1 OUT-MIGRATION OF PHYSICIANS

The City of Kamloops and a number of public comments expressed concern about the potential for out-migration of physicians and future challenges in recruiting physicians to Kamloops if Ajax is developed. KAM said that the degree to which physicians may ultimately choose to leave the community is difficult to predict given the wide array of factors that would enter into such a decision for an individual.

KAM committed to ensure that a dedicated general practitioner is contracted to provide health services to the construction workforce to reduce potential incremental demands on the Royal Inland Hospital and local clinics/physicians. In addition, KAM said it would work with the City of Kamloops, the Interior Health Authority, and other concerned community organizations, to identify ways in which KAM might support physician recruitment and retention, and improve access to health services.

11.3.2 IMPACTS TO DARK SKY

During the public comment period, the Kamloops Astronomical Society (KAS) and the Light-Pollution Abatement Committee of the Royal Astronomical Society of Canada (RASC) raised concerns regarding the potential for sky glow affecting the Stake Lake Observatory, among other sky viewing areas south of Kamloops.

The RASC indicated that the LED lighting proposed by KAM to mitigate sky glow from Ajax could have negative implications if the incorrect color temperature is selected. KAS also noted concerns with the use of LED lighting and questioned whether these lighting systems are adequate for industrial lighting safety requirements. The City of Kamloops also provided information regarding specific lighting design and mitigation measures that they recommended KAM follow. KAM committed to a collaborative working relationship with RASC and KAS, as well as the City of Kamloops. KAM committed that Ajax's contribution to sky glow would be minimized through a light mitigation and management plan, which would:

- Reduce lighting, by using timers, motion sensors, and planning to avoid the use of lighting when not required;
- Control lighting, by using shielded and/or directed lighting to minimize the amount of light required; and
- Make best use of technology, including using appropriate LEDs to control spectral characteristics of light used on site and limit the effects on sky glow.

Following review of the technical memo, "1028_KAM_Dark Sky Assessment", the City of Kamloops continued to raise issues about the rigour and accuracy of KAM's method and results of the revised dark sky assessment, arguing that the analytical techniques created high uncertainty in the dark sky impacts. The City recommended a specific approach to monitoring and management of dark sky effects. As stated in the memo, it was KAM's perspective that their artificial light at night assessment likely overestimates the effects as the highest modelled light intensities are brought up to the boundary of Ajax and the assessment does not consider KAM's commitments and mitigation measures to reduce spill, glare and sky glow impacts. The EAO has considered the City's input and KAM's perspectives in the development of a proposed EA Certificate condition requiring a light pollution management and monitoring plan. The EAO recognizes that the issue of the magnitude and extent of light pollution impacts remains unresolved from the perspective of the City of Kamloops.

11.3.3 IMPACTS TO VISUAL QUALITY

The Aberdeen Neighbourhood Association indicated that, from their perspective, the visual impacts of Ajax are not consistent with KAMPLAN objectives and as a result they may affect future development of the City of Kamloops. In addition, Aberdeen Neighbourhood Association said that the visual effects of Ajax on the Jacko Lake area would be greater than the EIS/Application determined.

KAM noted that changes were made to project design to reduce the visual impacts of Ajax from the City of Kamloops and from the Coquihalla Highway. No portions of Ajax would be visible from City of Kamloops neighbourhoods due to the topography (located behind Coal Hill), but it would be visible to recreational users in the grasslands south of Coal Hill. KAM said that changes in views from Jacko Lake, Lac Le Jeune Road, Edith Lake, and Coal Hill would be most notable. KAM said that visual impact from the Coquihalla Highway is anticipated to be slight, particularly from moving vehicles.

KAM also recognized that some landowners in the Knutsford area and other rural residences in the vicinity of Ajax may experience project related visual quality changes. KAM committed to engage with these landowners on an individual basis to identify and address potential concerns and to explore site specific mitigations where feasible.

With regard to the visual effects to areas that are identified within KAMPLAN for potential future development, KAM noted that these areas do not have a current development plan and also noted that the City of Kamloops was undergoing a review and potential update of the KAMPLAN.

11.3.4 MENTAL HEALTH AND THE HEALTH OF VULNERABLE POPULATIONS

A report by GatePost Risk Analysis and Habitat Health Impact Consulting Corp. (GatePost Report), on behalf of the Coalition of Concerned Citizens and the Kamloops Physicians for a Healthy Environment Society, reviewed the potential effects regarding community health and wellness outcomes.

The Gatepost Report expressed concern that the EIS/Application did not directly assess the role of psycho-social components of health, such as stakeholders' perceptions of risk related to Ajax. According to the report, a person's perception of risk due to Ajax could increase their stress levels. In their response, KAM acknowledged that potential effects on mental health and stress due to Ajax were not explicitly addressed in the EIS/Application. However, KAM said that potential project effects that may have an influence on mental health were assessed in various sections of the EIS/Application and that mitigation measures are identified in the EIS/Application to minimize adverse effects.

KAM reported that perceived risks tend to be related to a lack of trust and confidence in Ajax and proponent. As such, KAM said it is committed to be transparent in their information sharing in order to build trust with stakeholders. KAM also highlighted it intends to contribute and/or support initiatives beyond direct project effects through a community investment program.

The GatePost Report also said that input from stakeholders and an examination of health effects on vulnerable populations was missing from the EIS/Application. KAM noted that key person interviews were conducted to collect baseline information for social, economic and community health topics. In addition to the interviews, additional meetings and workshops were organized with the City of Kamloops and TNRD. KAM stated that their studies, including the HHRA, were designed to consider the most vulnerable populations so that others (less vulnerable) would also be inherently protected.

11.4 ANALYSIS AND CONCLUSIONS OF THE EAO

The effects of Ajax on access to healthcare services, visual quality, and dark sky were considered in this assessment of impacts to community well-being.

11.4.1 ACCESS TO HEALTHCARE SERVICES

The EAO is of the view that KAM's commitment to contract a general practitioner for Ajax employees during construction would reduce potential project demands on local healthcare services. To help mitigate the potential impacts to healthcare access as described, the EAO is proposing an EA Certificate condition requiring KAM to develop and implement a Construction Workforce Accommodation and Health Services Plan. In consideration of the proposed Construction Workforce Accommodation and Health Services Plan condition under the EA Certificate, the EAO is of the view that Ajax would not impact the availability of local physicians during construction. During operations, the EAO considers the impact of in-migration of Ajax workers to be within the forecasted population growth estimates and notes that the Interior Health Authority holds the mandate for the recruitment and hiring of healthcare workers to meet population demands.

The EAO is of the view that the potential risk of project related traffic accidents would largely be mitigated through the proposed improvements to interchanges and intersections near the project site and through implementation of the traffic management plan as proposed by KAM. In consideration of the proposed traffic management mitigations, the EAO is of the view that the project would not have discernable impacts to healthcare services as a result of increased traffic accidents.

11.4.2 VISUAL QUALITY

After considering relevant proposed mitigation measures including the design changes to the Ajax layout, the EAO concludes that Ajax would alter visual quality for some rural landowners and Indigenous and recreational users of the surrounding area that would adversely affect community well-being. The EAO recognizes KAM's commitment to explore site specific visual quality mitigations are feasible, but is of the view that the potential impacts to visual quality from some affected properties and viewpoints would be unavoidable. The EAO considers that the magnitude of effects to visual quality for most vantage points assessed in the EIS/Application would be negligible; however, the EAO notes that medium to high magnitude impacts to visual quality would occur for four of the rural vantage points[52] outlined in the EIS/Application, in a progressive fashion, as Ajax moved from construction to the final years of operations. Impacts would diminish following reclamation and would become less noticeable as rural residents become accustomed to the modified landscape following reclamation. The EAO concludes that the anticipated impacts to visual quality are highly likely and would have a low magnitude effect on overall community well-being.

11.4.3 DARK SKY

The assessment of dark sky effects under the Ajax EIS/Application is the first time this valued component has been included in an EA by the EAO. As such, there is limited policy guidance from regulators with which to assess the adequacy of dark sky assessment methods and results.

The EAO considers that dark sky values would be affected by sky glow or glare from Ajax which may impact residents of Kamloops and Knutsford and other stakeholders including users of the Stake Lake Observatory. The EAO considers the greatest effects would be experienced by those residing near the Ajax area. The EAO notes that while KAM has committed to mitigation, these measures must also consider WorkSafe BC regulations. The EAO acknowledges that the City of Kamloops does not agree with the Dark Sky assessment, and has expressed a concern about the uncertainties of the extent to which users of the Stake Lake Observatory may be affected. Overall, the EAO is of the view that magnitude and extent of impacts to dark sky can be reduced by KAM's proposed mitigation measures during detailed Project design, but that some residual impact to dark sky from sky glow would remain during operations. The EAO also notes that effects from glare and spill light from haul truck traffic and from the ore processing plant may also effect nearby residences with a line of sight of these activities. The EAO is proposing an EA Certificate condition that would require KAM to develop and implement a Light Pollution Monitoring and Management Plan in consultation with relevant stakeholders including the City of Kamloops. The EAO also notes that further light pollution mitigation measures would be developed during the detailed design phase if Ajax proceeds.

The EAO concludes, in consideration of the mitigation measures and proposed EA Certificate condition for dark sky, that low magnitude impacts to dark sky as a result of increase in sky glow are anticipated for the Ajax regional study area; however, the sky glow effects may be less noticeable in directions where Ajax light emissions coincide with light emissions from existing industrial facilities, the City of Kamloops neighbourhoods, and the lighting from local and regional transportation infrastructure. The EAO considers that some properties in close proximity and with a direct line of site of Ajax may experience medium magnitude effects from glare and spill light. Overall, dark sky impacts would occur sporadically during construction, continuously during operations, and would be reversed following decommissioning and closure. The likelihood of impact is considered moderate assuming KAM's proposed mitigations are effective. In this assessment, the EAO acknowledges technical uncertainties associated with KAM's dark sky assessment method and the available details regarding lighting mitigation measures at the EA stage. The EAO concludes that the anticipated impacts to dark sky would have a low magnitude effect on overall community well-being.

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[52] Edith Lake and Lake le Juene roads, Coal Hill, and Jacko Lake Boat launch are expected to have moderate to high magnitude effects to visual quality.

The EAO's characterization of the residual effects of Ajax on community well-being, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A. The assessment of light pollution is also considered as an input to the property values assessment (see section 16).

11.4.4 CUMULATIVE EFFECTS

The EAO is of the view that past, present and future projects and activities, including impacts to community wellbeing from TMX, the Highland Valley Copper – Bethlehem Expansion, and the proposed Harper Creek Mine Project could contribute to cumulative effects to community wellbeing in the local and regional study areas. Contributions from present activities were measured by KAM in its description of baseline conditions for community health and wellbeing, access to healthcare, local and regional traffic, and visual quality. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual effects discussed above.

The EAO is of the view that future growth and expansion of the City of Kamloops related to TMX, the Bethlehem expansion, and the Harper Creek mine could potentially add to: the baseline demand for healthcare; levels of traffic on local and regional roads; and impacts to the region's visual quality, which Ajax would also contribute. The additive effect of these future developments, in combination with the residual effects of Ajax, could result in a cumulative effect to community wellbeing. The EAO is of the opinion that the overall cumulative effect to community wellbeing would be low in magnitude, since the Ajax impacts to healthcare demand would largely be negated by the onsite physician and the Ajax park and ride program for construction workers would alleviate most Ajax related traffic congestion; cumulative visual quality effects would be largely unavoidable and are considered medium magnitude.

11.4.5 CONCLUSION

Considering the above assessment and having regard to the implementation of applicable mitigation measures proposed by KAM, the provincial conditions identified in the table of conditions, and the Certified Project Description (which would become legally binding in the event that an EA Certificate is issued), the EAO is of the view that Ajax is not likely to have significant adverse residual effects to community wellbeing as defined in this section.

Overall, the EAO concludes that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to community wellbeing in the region.

12 Recreation

12.1 BACKGROUND

The assessment presented in this section is made in consideration of the valued component of outdoor recreation in the EIS/Application and the special topic section on Jacko Lake. Recreation was identified as a valued component due to the potential that recreational activities or areas may be lost due to Ajax or compromised by project effects (e.g., noise, air quality, visual impact). Given the local and regional importance of Jacko Lake as an angling destination, this section considers effects associated with local and regional recreation overall and gives particular focus on potential project effects to the angling experience on the lake.

12.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

KAM's assessment of the impacts to recreation and impacts to angling on Jacko Lake, along with relevant mitigation measures, are summarized below.

12.2.1 *DESCRIPTION OF BASELINE ENVIRONMENT*

Ajax is south of and adjacent to the City of Kamloops within fenced private land that is inaccessible for recreation pursuits. Although there are no designated provincial parks or protected areas in the immediate vicinity of Ajax, public areas surrounding the mine footprint are subject to frequent recreational use including activities such as hiking, boating, and fishing. Fishing occurs primarily in and around Jacko Lake.

KAM also noted that City of Kamloops planning recently emphasized developing parks, trails, and bike routes that enable informal, individual recreation within the City's boundaries.

12.2.2 *POTENTIAL EFFECTS AND MITIGATION MEASURES*

Ajax could reduce or alter access to outdoor recreational areas that are currently in or adjacent to the mine site (e.g., Goose Lake and Jacko Lake) and in the vicinity of the mine site (e.g., Coal Hill). Goose Lake would become part of the mine site and would no longer be available for recreational activities, and approximately 6 km of Goose Lake Road would be closed. While Goose Lake is not known for recreation (as it is located on private land, very shallow, and does not contain fish), studies indicate it is currently used by bird watchers, mountain bikers, and runners.

Jacko Lake is one of the top 20 lakes in the TNRD, with a mean of 4,094 angler days between 2008 and 2010. Jacko Lake is fished by the public between April and October when road access is maintained; there is no ice fishing allowed in the winter. It has been stocked with trout annually by the Freshwater Fisheries Society of BC since 1954. Ajax would result in the permanent loss of 832 m^2 (roughly 4% of the 2.08 hectares lake footprint) of the northeast arm of Jacko Lake due to the development of the open pit. During construction portions of the southeast arm of Jacko Lake would be temporarily unavailable while decommissioning and removal of the old dam occurs however access to these areas would be restored thereafter.

During blasting events, additional access restrictions for Jacko Lake would be enforced to protect public safety for about the first half of the mine life. KAM reported that public access to the buffer area would be restricted for an approximately two-hour window each day. For the second half of the mine life it is anticipated that blasting events within the open pit would be deep enough or far enough away from Jacko Lake to remove the requirement for regularly controlled access.

In addition to access restrictions, the experience of recreational users in the area would also be impacted by changes in air quality, noise and vibration, visual impacts, traffic, and the number of people using the area.

The EIS/Application states that during operations, mine activity would be visible from Jacko Lake, the Jacko Lake boat launch, and Coal Hill, and would dominate vistas from most parts of Edith Lake Road.

The EIS/Application reports that noise exceedances are expected on the north side of Jacko Lake during construction (specifically during daytime piling activities for a period of about two months) but that noise exceedances are not expected during operations at any other nearby recreational sites.

Air quality objectives are expected to be slightly exceeded during the construction and operation phases at the northeast mine site boundary; however, these exceedances would be infrequent and are expected to mainly occur in the winter when recreational users are less frequent. A description of air quality effects are outlined in section 8 of this Report.

The EIS/Application reported that changes to the abundance, distribution, and quality of harvestable resources (including fish and game) may deter some individuals from participating in fishing and hunting activities near the Ajax area. However, KAM stated that alternative hunting and fishing areas are nearby and easily accessible in the region.

The EIS/Application identified the following key proposed mitigation measures to address potential adverse effects to outdoor recreation:

- Development of an access management plan in order to safely manage access to Ajax, including ongoing access to recreational areas such as Jacko Lake, and communication with people using the area for recreation and other activities;
- Establishment of a recreation/angling working group made up of recreational users to maintain the quality of the fishing experience on Jacko Lake and other nearby fishing spots;
- Development of alternative fishing areas on Jacko Lake through fish habitat compensation to mitigate potential impacts from noise and vibration; and
- An improved boat ramp and day use facilities including a new shoreline trail.

12.2.3 CUMULATIVE EFFECTS

KAM identified TMX as the only project that could contribute to cumulative effects; however there are no known recreation sites or activities that occur where the two project areas physically overlap. As a result, KAM concluded there would be no cumulative effects to recreation.

12.2.4 MONITORING AND FOLLOW-UP

KAM committed to a series of monitoring plans for noise and vibration, air quality (including fugitive dust), surface water quantity, and water quality on the lake and its surrounding environment. Details on these monitoring plans, the results of which would inform recreational management decisions can be found in the respective valued component sections of this Report.

12.3 DISCUSSION OF ISSUES

During the EA, the EAO received and reviewed comments from the public, SSN, and the working group regarding the effects of Ajax on social and economic valued components. The primary issues related to recreation were impacts to angling on Jacko Lake and other outdoor recreation activities.

12.3.1 FISHING AT JACKO LAKE

Several public submissions and MFLNR raised concerns regarding potential effects on recreational fisheries at Jacko Lake due to potential effects on surface water quality, effects due to blasting, and general degradation of the fishing experience. KAM stated that Ajax would result in unavoidable impacts to Jacko Lake that would affect the recreational fishery.

Section 4 (Fish and Fish Habitat) and section 2 (Surface Water Quality and Quantity) of this Report discusses potential effects on fish and fish habitat and surface water respectively; in these matters, the Agency and EAO concluded effects would are unlikely to be significant.

In anticipation of requirements under the *Fisheries Act*, KAM developed a Conceptual Fish Habitat and Fishery Offsetting Plan to help mitigate potential effects, which includes dredging and enhancement of the west arm of Jacko Lake as the primary means to increase fish habitat and offset impacts to recreational fishing in the eastern portion of the lake. The following additional measures related to recreational fishing are also noted:

- Improved access to Jacko Lake via a new road that would lead to a new boat launch,
- An enhanced day use area and shoreline trails for fisherman; and
- No blasting in the western portion of the open pit near Jacko Lake between 10:00 am and 2:00 pm due, in part, to minimize effects related to chironomid hatch timing during the fishing season.

KAM said that, while there would be unavoidable impacts to the northeast arm of Jacko Lake and that anglers' fishing experiences would change due to Ajax, fish habitat offsetting works and improvements to the day use area would help offset these effects and would result in net gains of productive fish habitat and improvements to the overall fishing experience respectively over the long term.

12.3.2 ACCESS TO AND PARTICIPATION IN OTHER OUTDOOR RECREATION

Public comments expressed concerns related to potential effects on recreation near Ajax, including fishing, hunting, running, cycling, and hiking, including use and access of Goose Lake Road which would be closed in the area that overlaps the mine footprint. The concerns ranged from potential direct effects from mining operations, such as noise, light, dust, and views of an industrial site, as well as the perception that Ajax may affect the enjoyment of recreating outdoors.

KAM confirmed that there would be reduced access to recreational activities in areas near Ajax, and that there may also be reduced participation in recreational activities in the area. KAM also reported that public use of Goose Lake for recreation purposes or to access recreation sites is relatively low, and that alternative routes exist in the region. To help mitigate potential effects on outdoor recreation, KAM stated that they have opened access to recreation on some areas of their private ranch land and has proposed to develop new recreational opportunities near Ajax in the future. KAM has also committed to establishing an angling/recreation working group to guide the development of new or improved recreation resources, such as fishing and nature trails, in other areas.

12.4 ANALYSIS AND CONCLUSIONS OF THE EAO

The EAO's characterisation of the potential residual effects of Ajax on outdoor recreation, as well as the level of confidence in the effects determination, is summarized below.

12.4.1 RECREATION

The EAO notes that although project activities such as blasting, haul road traffic, and mineral processing, are likely to result in dust fall, noise, light spill, and aesthetic changes, it is unlikely to noticeably affect the recreational experience in the region overall. The EAO notes that the City of Kamloops and the TNRD provide an abundance of recreation areas within regional parks and protected areas and that current recreational use of the KAM-owned lands where Ajax is proposed is largely prohibited. The EAO acknowledges that KAM has also committed to support development of alternative recreation areas on KAM-owned lands, as well as mitigation measures for nuisance effects, and broader engagement with the community. However, the EAO is of the view that project related environmental effects could reduce people's willingness to recreate in areas within 1 km of the mine site.

Although Ajax falls almost entirely within private land, the secondary roads, such as Goose Lake Road and Lac Le Jeune Road, provide opportunities for bird watching, walking, and cycling; notwithstanding, the EAO understands that the volume of public use of these roads for these activities is relatively low. The EAO acknowledges that KAM retains the right to determine recreational opportunities on their fee simple lands.

The EAO considers that project activities are likely to reduce access to and enjoyment of the Jacko Lake recreational fishery. The EAO acknowledges the long term benefits that the proposed improvements to the boat launch, the day use area, and fish habitat improvements to the western reaches of Jacko Lake would accrue to the recreational fishery on Jacko Lake. The EAO acknowledges that KAM has proposed a suite of mitigations to reduce the disruption that anglers will experience as a result of blasting noise and safety zones, although there is some uncertainty as to how users may respond to the change in the angling experience. To ensure that residual effects to the recreational access near the Ajax site and the angling experience on Jacko Lake are managed consistently over the life time of Ajax, the EAO proposes an EA Certificate condition that would require KAM to develop a Jacko Lake Recreation Management Plan.

The EAO is of the view that, following mitigations and in consideration of the proposed EA Certificate conditions to address effects on recreational access and effects on the recreational fishing experience on Jacko Lake, a residual impact to recreation would remain.

The EAO concludes that Ajax would have a low magnitude impact to local and regional recreation through the loss of access on Goose Lake Road, which would last throughout the life of the Project until such time as an alternative route for the road is established. The likelihood of impact to recreational access near the project site is considered high.

The EAO also concludes that Ajax would have a medium to high magnitude impact to the angling experience on Jacko Lake contingent upon the daily blasting schedule and requisite blasting safety buffers. The EAO considers that Zone 3 blasts (scheduled to occur daily for approximately 13 years), in an additive fashion with dust, noise, and visual effects, are likely to result in high magnitude impacts to the angling experience on Jacko Lake as minimum distance safety restrictions would require anglers to temporarily leave the eastern half of the lake. Medium magnitude impacts would result when blasting is not taking place in zone 3 of the pit. Effects on the Jacko Lake angling experience from noise, dust, and changes in water quality are anticipated to be continuous and last throughout construction and operations, while visual impacts would persist beyond operations. Following decommissioning and closure, the EAO anticipates the recreational fishing experience to improve and effects would largely be reversed although topographic changes would be permanent. The likelihood of impact to the fishing experience on Jacko Lake is considered high.

The EAO has a moderate level of confidence in this assessment given the variation in angler preferences and tolerance for disruptions from the current baseline. The EAO's characterization of the residual effects of Ajax on recreation, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

12.4.2 CUMULATIVE EFFECTS

The EAO is of the view that past, present and future projects and activities, including future Kamloops population growth and TMX could contribute to cumulative effects to recreation in the local and regional study areas. Contributions from present activities were measured by KAM in its description of baseline conditions for recreation including angling on Jacko Lake. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual effects discussed above.

The EAO is of the view that future growth and expansion of the City of Kamloops, and the development of TMX, could potentially add to the baseline angling demand on Jacko Lake. The additive effect of future residential development and TMX, in combination with the residual effects of Ajax, could result in a cumulative effect to recreation; however, cumulative effects to recreation would be largely dependent on the timing and duration of TMX construction. Assuming that TMX construction coincides with Ajax construction, the EAO is of the opinion that cumulative effects to recreation would be low in magnitude as any cumulative effect would largely only affect angler access to the lake, with the angling experience remaining similar to baseline. Should TMX construction coincide with Ajax operations, in particular during blasting in zone 3, the EAO is of the opinion that the cumulative effect to recreation would be moderate in magnitude as the angling experience on Jacko Lake would be further affected.

12.4.3 CONCLUSION

Considering the above assessment and having regard to the implementation of applicable mitigation measures proposed by KAM, the provincial conditions identified in the table of conditions, and the Certified Project Description (which would become legally binding in the event that an EA Certificate is issued), the EAO is of the view that Ajax is not likely to have significant adverse residual effects to outdoor recreation opportunities locally and regionally; however, the angling experience on Jacko Lake during construction and operations would be significantly altered.

Taking into account the implementation of applicable recreation and Jacko Lake angling measures proposed by KAM and the proposed EA Certificate conditions, the EAO concludes that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects to recreation in the region.

13 Accommodation, Infrastructure, Public Facilities and Services

13.1 BACKGROUND

This section assesses the potential impacts of Ajax on the public infrastructure, facilities, and services valued component. This valued component was selected for assessment because of the potential effects from the construction, operations, and decommissioning of Ajax. The section also assesses effects associated with housing the Ajax construction workforce.

The City of Kamloops and the TNRD have undertaken land use and development planning processes over the past few decades. In general, the City of Kamloops' Official Community Plan ('KAMPLAN') is focused on municipal growth including infrastructure upgrades and covers areas adjacent to the northern Ajax boundary. The TNRD's South Kamloops Official Community Plan outlines development objectives and zoning for the lands south of the Kamloops city limits which overlap the Ajax boundaries. The TNRD would be the local government taxing jurisdiction for Ajax.

The City of Kamloops operates municipal services that would be expected to interact with Ajax, including landfills, fire and emergency services, and wastewater treatment. The City of Kamloops is serviced by an RCMP detachment.

13.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

The EIS/Application states that Ajax may result in an increase in both temporary and permanent populations during the construction and operations phases, which could lead to increased pressure on housing, local facilities, services, and infrastructure.

In consideration of Ajax's interactions with the infrastructure, public facilities and services valued component, KAM identified the following potential adverse effects during construction and operations:

- Increased demand for housing and accommodations as a result of worker in-migration during construction;
- Increased stress on municipal infrastructure and municipal waste services due to Ajax workforce and project activities; and
- Increased traffic volumes and effects on public road infrastructure related to the increased number of new residents commuting to the mine site.

13.2.1 ACCOMMODATION IMPACTS DURING CONSTRUCTION

The EIS/Application notes that the BC Real Estate Association considered the Kamloops residential housing stock to be sufficient and balanced[53] from the period of mid- 2013 through to the end of Quarter 1 2015. The Canadian Mortgage and Housing Corporation (CMHC) reported that the vacancy rate in Kamloops for rental apartments with three or more units was 5.1% in April 2015. In 2014, hotels and motels in Kamloops had an occupancy rate of at least 50% for two-thirds of the year, while in the summer months occupancy rates typically increase (up to 81% in August of 2014).

The EIS/Application predicts that the workforce would fluctuate during the three-year construction period, peaking at 1340 employees in year two. Of those, KAM estimated there would a maximum of 648 to 950 non-local hires that would require local temporary accommodation. [54] KAM indicated that the increased demand for housing and accommodations would have the potential to impact Kamloops' ability to attract tournaments, Kamloops' general tourism, and Kamloops' housing affordability.

13.2.2 AJAX IMPACTS TO MUNICIPAL INFRASTRUCTURE AND SERVICES

KAM predicts that Ajax would generate an estimated 1,080 t of domestic waste annually during construction and 730 t of waste annually during operations. KAM stated they anticipate using the Mission Flats Landfill to dispose of domestic waste, which is one of two landfills operated by the City of Kamloops. KAM noted that the City of Kamloops is currently completing a design and operation plan for Mission Flats Landfill, which is expected to be in operation until at least 2053.

KAM estimated that Ajax would generate 550 t of sewage during construction and 2,435 t in total during operations and that the sewage would be trucked to municipal sewage lagoons operated by the City of Kamloops. KAM noted that the City of Kamloops recently upgraded its wastewater treatment facilities, which are expected to be able to accommodate the City's forecasted population growth through 2031. KAM noted that initial discussions with the City of Kamloops regarding the use of the wastewater treatment facilities have indicated that the additional sewage produced by Ajax could be accommodated by municipal facilities. KAM stated that they intend to enter into service agreements with the City of Kamloops regarding the use of the municipal landfill and wastewater treatment facility. [55]

KAM noted that Kamloops Fire Rescue and Emergency Medical Service response times for some Kamloops neighbourhoods may be impacted from project related in-migration depending on where future population growth occurs. According to the EIS/Application, the Kamloops RCMP detachment is experiencing challenges recruiting officers to fill vacant and new positions, similar to other regional detachments in BC. KAM reported that the current shortage in human resources for the RCMP is not expected to improve within the next three years.

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[53] A housing market is considered balanced when the sales to active listings ratio is in a range of 14 to 20 %; a balanced market results in home prices remaining relatively stable.

[54] During operations, the workforce is predicted to be 468 employees, of which a maximum of 43% would be non-local.

[55] As of July 2017, the City of Kamloops has not confirmed whether such agreements will be available in consideration of the expected population growth in the City and notes that KAM may need to consider alternate means of waste disposal.

KAM stated that during the decommissioning and closure, and post closure phases, Ajax would continue to make use of public infrastructure (e.g., landfills and waste treatment) and the public road network at a lower rate compared to the construction and operations phases.

13.2.3 IMPACTS TO TRAFFIC AND TRANSPORTATION INFRASTRUCTURE

KAM's Traffic Impact Assessment reported that increased traffic volume during construction and operation, has the potential to affect the quality, condition and safety of interchanges and roadways. The Traffic Impact Assessment concluded that the total traffic volumes at the peak of project construction are expected to have an adverse effect on the traffic flows at the Inks Lake Interchange and at the intersection of Lac Le Jeune Road and Ajax Access Road. KAM expected these effects to be concentrated at these sites because traffic accessing the mine site from all directions would meet at the Inks Lake Interchange and travel through the Lac le Jeune and Ajax Access Road intersection.

KAM's Traffic Impact Assessment also stated that intersection traffic may also be affected in certain locations. Traffic through the Pacific Way/Hugh Allan Drive, Versatile Drive/Hugh Allan Drive, and Frontage Road/Copperhead Drive intersections may be delayed during peak hours of the first year of construction. The roundabout at the intersection of Versatile Drive and Hugh Allan Drive was noted in the baseline as having capacity constraints and would continue to do so during construction as Ajax would exacerbate the pre-existing capacity constraints. Ajax is expected to have minimal effects on traffic during operations compared to the base case.

To address the potential adverse effects to accommodation, infrastructure, public facilities, and services, KAM proposed mitigation measures, including:

- Development of a human resource management plan prior to construction to maximize local hires and reduce potential accommodation pressures associated with migrant workers;
- Development of a construction workforce accommodation plan, which would evaluate potential community concerns about the selected accommodation options; identify means of mitigating these concerns; and outline a communication protocol for relevant employees and stakeholders;
- Establishment of a Community Liaison Group (CLG) comprising representatives from the City of Kamloops, TNRD, and other relevant organizations to review accommodation and traffic issues among other project related issues;
- Development of service agreements with the City of Kamloops for the use of municipal landfill and municipal water treatment facilities, to ensure that the infrastructure can accommodate project waste;
- Development and implementation of a transportation management plan that will include mitigation measures to reduce potential traffic impacts, such as staggering shift schedules, carpool incentives and workforce shuttles from key locations to reduce personal vehicle traffic during peak periods throughout construction and operations, and monitoring of traffic impacts related to Ajax;
- Construction of an upgraded Inks Lake Interchange on Highway 5 to improve access to the Ajax site; and
- Improvement to road and signage at Lac le Jeune Road.

13.3 DISCUSSION OF ISSUES

During the EA, the EAO received and reviewed comments from the public, Indigenous groups, and the working group. From these comments, the EAO identified three key issues related to the accommodation, infrastructure, public facilities, and services valued component. A full list of issues raised and KAM's responses can be found on the EAO's website.

13.3.1 TEMPORARY ACCOMMODATION

The City of Kamloops expressed concerns that during peak tournament and event periods, the increased burden on hotels and motels from the construction workforce may create challenges in providing adequate accommodation for Tourism Kamloops' Tournament Capital Program. The City of Kamloops also said there could be potential effects from an increased workforce on the short-term rental market, making housing difficult to access or less affordable for students and low-income families. The City of Kamloops recommended that a formalized issues management system be put in place to address potential effects on temporary accommodation.

In response, KAM committed to maintain ongoing dialogue with relevant organizations, including Tourism Kamloops, to inform them of Ajax's workforce requirements and timing. KAM has also committed to developing and implementing a construction workforce accommodation plan, in consultation with the City of Kamloops, Indigenous groups, and stakeholders, to identify the preferred worker accommodation option, and to identify and manage potential impacts and concerns. KAM indicated that this may result in one or a combination of fit-for-purpose camps and use of local hotels/motels or other facilities.

In addition, as part of the construction workforce accommodation plan, KAM has committed to minimizing impacts on local rental housing by, with the exception of certain senior staff, avoiding the use of rental market housing (e.g. private apartments and houses in Kamloops) for construction worker accommodation. KAM also committed to avoid using per diem or per month accommodation allowances for construction workers as these allowances may have an inflationary effect on rental prices.

KAM concluded that the CLG would provide a forum to facilitate issues resolution, communicate monitoring results, identify opportunities for partnerships, and to apply adaptive management related to impacts on temporary accommodation.

The City of Kamloops and KAM indicated to the EAO that impacts to temporary accommodation and housing affordability were included in their bilateral discussions on a potential community benefit agreement.

13.3.2 MUNICIPAL INFRASTRUCTURE AND SERVICES

During the EA, the City of Kamloops expressed concern about KAM's proposed service agreements suggesting they lacked sufficient details to assess the acceptability of the proposal. In response, KAM committed to continue to work with the City of Kamloops to finalize service agreements for the use of the municipal wastewater treatment facility and landfill, prior to construction.

The City of Kamloops also raised questions about who would cover costs associated with increased municipal service delivery for policing and healthcare that could result from workers and their families moving to Kamloops or from potential increases in traffic accidents. In response, KAM provided information about the taxation benefits associated with Ajax and said that the providers of each service, such as the RCMP and IHA, would be responsible for addressing increases in demand associated with population growth. KAM also made commitments, such as the workforce accommodation plan and the human resources plan, that are intended to reduce potential impacts to municipal health and police services. KAM also noted provisions in their transportation management plan which they claimed would reduce the probability of project related traffic accidents.

For additional discussion on potential effects to healthcare service provision and capacity issues and KAM's mitigation measures, see section 11 (Community Well-being).

The City of Kamloops and KAM indicated to the EAO that impacts to city infrastructure were included in their bilateral discussions on a potential community benefit agreement.

13.3.3 DEMAND ON TRANSPORTATION INFRASTRUCTURE

The City of Kamloops raised concerns about how Ajax related increases in road activity may affect local road conditions and maintenance schedules, and asked who would be responsible for the additional costs. KAM responded that to maximize safety for road users and to reduce traffic impacts to local road conditions associated with Ajax, it has committed to upgrading the Inks Lake Interchange, Ajax Access Road, and the Lac Le Jeune Road crossings; the EIS/Application suggests the improvements to transportation infrastructure would be completed in year two of construction. However, KAM noted that the exact details regarding supporting infrastructure such as access roads, and the timing and funding of these activities, are subject to discussion with MOTI and other relevant government agencies.

The City of Kamloops also requested clarity on KAM's plans for transporting workers during construction. KAM said that to reduce the volume of employee road use and overall travel demand during construction as well as through the operational life of the mine, KAM would develop and implement a Transportation Management Plan, in consultation with MOTI and the City of Kamloops. The Transportation Management Plan would require project related traffic to use designated roads to limit potential effects to road conditions from heavy vehicles and to help reduce roadway congestion. During construction, KAM said that the Transportation Management Plan would require 85% of employees to use company-provided transportation (e.g., buses) likely provided through a park-and-ride program.

To support the effectiveness of these mitigation measures, KAM said that under the Transportation Management Plan, it would monitor the condition of Lac Le Jeune Road, report on transportation incidents, monitor the park-and-ride program, including potential spot checks by KAM staff, and establish a complaints/feedback log on a dedicated Ajax website. KAM noted that details of the temporary access plan, including monitoring, reporting, and additional management options, would be finalized with MOTI during Ajax permitting. KAM committed to summarizing this monitoring in annual public/external reports, which would be provided to MOTI for review and the City of Kamloops for their information.

During the EA, the public raised concerns that road closures could impede personal safety and the ability to manage forest fires, particularly the proposed closure of Goose Lake Road. Following direction from MOTI, KAM provided an assessment of alternatives for Goose Lake Road which noted that the closure of Goose Lake Road would require emergency vehicles to be re-routed around the project site. KAM proposed that, in the event of a wildfire near Ajax, Ajax site management would initiate monitoring of the fire and work with the responsible authorities and key KAM personnel would be put on standby pending an evacuation. According to KAM, a detailed traffic management plan would also be submitted to MOTI as a part of mine permitting. At closure, KAM has proposed to provide an alternative route around closed mine facilities that would serve a similar purpose as Goose Lake Road.

Overall, KAM predicted that road access around Ajax site would be similar to current conditions, although there may be instances of project-related traffic congestion for the first six months of construction while new and upgraded roads are being built. The ability of residents to access or leave the area in the event of an emergency would not be affected. KAM committed to ongoing and regular discussions with stakeholders as a key component of managing impacts to transportation infrastructure.

The City of Kamloops and KAM indicated to the EAO that impacts to city-owned road infrastructure were included in their bilateral discussions on a potential community benefit agreement

13.4 ANALYSIS AND CONCLUSIONS OF THE EAO

With consideration of the mitigations outlined in KAM's applicable management plans, the EAO anticipates that Ajax could result in the potential following residual effects to the accommodation, infrastructure, public facilities and services valued component:

- Reduced availability of temporary accommodation during the construction phase;
- Increased demand on municipal infrastructure and waste services; and
- Increased demand on transportation infrastructure, particularly during construction.

13.4.1 TEMPORARY ACCOMMODATION

The EAO acknowledges KAM's commitment to implement a Construction Workforce Accommodation Plan that would involve the identification and analysis of various accommodation options and associated issues or concerns; the EAO is of the view that this commitment is a reasonable approach to monitoring and mitigating potential effects. The EAO notes that KAM is still in discussions with the City of Kamloops, Tourism Kamloops, and other stakeholders on the most appropriate housing strategy for the Ajax construction workforce. To help ensure potential effects from the temporary workforce to housing in the region are managed, the EAO has proposed an EA Certificate condition requiring a Construction Workforce Accommodation and Health Services Plan.

The EAO acknowledges KAM's commitment to working with the City of Kamloops to develop a CLG which would be used, among other tasks, as a forum to discuss monitoring of impacts to temporary accommodation and discuss further mitigation measures if effects to temporary accommodation are greater than predicted in the EIS/Application. The EAO has proposed an EA Certificate condition requiring KAM to establish a CLG during all phases of Ajax, based on the draft Terms of Reference for the CLG that was developed during the review.

Based on KAM's commitments under the proposed CLG, the construction workforce accommodation plan and related mitigation measures outlined in the EIS/Application, the EAO considers that residual impacts to temporary accommodation would be low in magnitude and would occur sporadically throughout the year with a higher potential for effects during the summer travel months. Effects to temporary accommodation would occur throughout the City of Kamloops, be limited to the construction phase, and cease (or be reversed) during operations. The EAO considers the likelihood of the effect to temporary accommodation, as described above, to be high.

13.4.2 MUNICIPAL INFRASTRUCTURE AND SERVICES

The EAO acknowledges the views of the City of Kamloops that Ajax has the potential to result in residual effects to municipal infrastructure and services, particularly landfill and wastewater treatment, as a result of project activities and an increased workforce. The EAO notes that, according to the EIS/Application, the current capacity in these systems is sufficient to accommodate the projected waste stream from the proposed mine. In consideration of the proposed mitigations, the existing waste stream capacity, and KAM's intention to enter into services agreements with the City of Kamloops, the EAO expects a negligible effect to municipal infrastructure.

To mitigate behaviours, such as drug and alcohol use, violence, and solicitation of prostitution, that may be associated with temporary workers who are predominantly male with relatively high disposable incomes, KAM has committed to reduce the number of non-local workers and that all construction workers will be required to sign and adhere to a worker code of conduct. In consideration of these proposed mitigations and given the current high caseload demands facing the RCMP detachment in Kamloops, the EAO is of the view that Ajax could result in a low magnitude increase in demand for police services. The effects on police services would occur sporadically during construction in Kamloops, and most likely limited to specific establishments in the city at night and on the weekend. The magnitude of effect would diminish to negligible during operations as the construction workforce migrates elsewhere for work.

13.4.3 TRANSPORTATION INFRASTRUCTURE

The EAO acknowledges that upgrades to the interchanges at Inks Lake and Lac le Jeune Road are likely to create low magnitude traffic congestion during the 6 month interchange construction phase. The EAO acknowledges KAM's commitment to develop a transportation management plan that includes mitigation measures that would reduce (although not eliminate) the number of vehicles accessing the mine site during construction; the EAO concurs that the operations phase should not impact traffic or transportation infrastructure substantially. Recognizing that details regarding traffic and transportation infrastructure will be further developed prior to construction, should Ajax proceed, the EAO has proposed an EA Certificate condition requiring a Traffic Management and Monitoring Plan.

The EAO's characterization of the residual effects of Ajax on infrastructure, public facilities and services, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

13.4.4 CUMULATIVE EFFECTS

The EAO is of the view that past, present and future projects and activities, including TMX, the proposed Harper Creek Mine Project, and future Kamloops city growth could contribute to cumulative effects to accommodation, infrastructure, and public facilities and services in the local and regional study areas. Contributions from past and present activities were measured by KAM in its description of baseline conditions for infrastructure, and public facilities and services. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual effects discussed above.

13.4.5 CONCLUSION

Considering the above assessment and having regard to the implementation of applicable mitigation measures proposed by KAM and the Province's proposed conditions and the Certified Project Description (which would become legally binding in the event that an EA Certificate is issued), the EAO is of the view that Ajax is not likely to cause significant adverse residual effects on accommodation, infrastructure, public facilities, and services.

Taking into account the implementation of applicable community benefits being proposed by KAM and the proposed EA Certificate conditions and the low likelihood of overlap with other reasonably foreseeable future projects, the EAO concludes that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to cause significant adverse cumulative effects to accommodation, infrastructure, and public facilities and services.

14 Local and Regional Economy

14.1 BACKGROUND

This section assesses the potential adverse effects of Ajax on economic valued components. Although presented separately in the EIS/Application, this section of the Report combines the assessments for: economic growth, labour force, employment and training, income, business, and economic diversification. The local study area and regional study area in the Economic Growth section of the EIS/Application were adopted for the assessment of effects to the local and regional economy.

14.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

KAM's assessment of Ajax's potential impacts to these valued components is summarized below, along with relevant mitigation measures.

The local study area represents the primary area where project workers would be hired and/or reside in. The local study area would also receive project expenditures on goods and services, project employee spending, and where businesses supplying goods and services will be located.

KAM stated that the regional study area includes the TNRD and communities within a 1.5-hour driving distance of Ajax (e.g., Merritt, Logan Lake, Chase) and that Ajax may attract workers from Indigenous and non-Indigenous communities throughout the regional study area. Ajax is also expected to generate indirect and induced income opportunities across the regional study area.

14.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

The 2011 labour force in the TNRD is 67,415 people, which includes a labour force of 49,020 people in the City of Kamloops. Employment by industry for the TNRD population largely reflects that of Kamloops. The top five industries in the TNRD reflected approximately 41% of the labour force and include the retail, health care and social services, construction, accommodation and food service, and public administration sectors, which is similar to that observed for BC. The unemployment rate in Kamloops and the TNRD in 2011 was 8.4%.

KAM estimated revenue and employment benefits during construction and operations. KAM stated, and the EAO acknowledges, that Ajax would have local, regional, and national economic benefits over the construction phase and operations phase, as well as lesser benefits over the decommissioning and closure phase, which are not enumerated here. KAM assessed direct expenditures and direct employment benefits as well as indirect (supply chain) and induced (spending by workers) benefits. KAM estimated direct, indirect, and induced employment income during construction and operations of the project using Statistics Canada Input-Output model, which is a standard economic impact model regularly used in EAs.

KAM stated that the construction phase would result in 9,725 person years of employment in BC and 3,715 person years of employment in the rest of Canada (excluding BC). During operations, Ajax would, on average, employ 1,450 full time equivalent positions in BC and 540 in the rest of Canada. KAM proposed a local hiring strategy, and presented scenarios in the EA for low and high levels of local employment.

KAM estimated Ajax construction phase expenditures (e.g. capital costs, equipment, supplies) at $1.54 billion and the operations phase expenditures at $299 million per year on average, or $6.9 billion in total over the 23-year operations phase.

Section 1.6 of this Report summarizes the estimated ranges of local hires, income generation, and estimated government revenue.

14.2.2 KAM EFFECTS AND MITIGATION MEASURES

14.2.2.1 *Economic growth, labour force, employment and training, income, business*

The EIS/Application identified the following potential adverse effects on the economic valued components:

- Increased labour competition during construction and operations;
- Decrease in economic activity and government revenues during decommissioning and closure;
- Reduced employment and training opportunities during decommissioning and closure; and
- Decreased income generation as a result of decreased employment during decommissioning and closure.

In the EIS/Application, KAM stated that stakeholder interviews with representatives from nearby mining operations and support service providers raised concerns that existing employees could leave their current positions in order to seek employment with Ajax. KAM acknowledged that direct mining employment generally has higher compensation levels than businesses providing services and supplies to the mining sector. This could lead to competition for labour and increased labour costs for local businesses. KAM stated these concerns were particularly acute for the small to medium-sized businesses that supply the mining sector.

14.2.2.2 *Economic diversification*

In the EIS/Application, KAM measured baseline levels of economic diversity in the local study area and regional study area using two key indicators: the income dependency ratio and the economic diversity index. These indicators are used in recent studies published by the Province that examine the extent to which local economies in BC are economically dependent on various sectors using 2006 Census data. With some localized exceptions, the TNRD demonstrates a similar economic diversity to that of the Kamloops Local Area. For example, Merritt and North Thompson have greater income dependencies on the forestry sector and thus have lower diversity indexes than Kamloops.

According to the EIS/Application, during construction and operations, employment and expenditures would be expected to continue supporting a diverse economy in Kamloops. As levels of expenditures and employment decrease at the end of operations and during decommissioning and closure, the influence of Ajax on the economy in the local study area and regional study area would decrease. Decommissioning and closure could result in a slight decrease in the economic diversity of the region. The EIS/Application does not propose any mitigation measures related to economic diversification.

14.3 DISCUSSION OF ISSUES

During the EA, the EAO received and reviewed comments from the public, SSN, and the working group regarding the effects of Ajax on economic valued components. The primary issues related to the local and regional economy were:

- Increased labour competition and income effects;
- Local tax contributions of Ajax;
- Potential adverse effects on existing businesses;
- Potential economic effects of population out-migration;
- Potential adverse effects to local economic diversity; and
- KAM's estimation of economic benefits.

14.3.1 INCREASED LABOUR COMPETITION AND INCOME EFFECTS

During EIS/Application review, the City of Kamloops, SSN, and the public raised questions and concerns about the potential for increased labour competition during construction and operations. Public comments were concerned about the potential for increased costs for local and regional businesses due to staff turnover and wage increases.

Public comments noted that the job estimates provided by Ajax were uncertain and may not create a substantial beneficial effect in the local labour market.

KAM responded that it is committed to developing a Project recruitment strategy to maximize local employment and procurement, and plans to work with local partners to identify key training needs and opportunities. As a result, KAM stated that during the 23-year operation phase, the majority of workers will be hired locally. KAM noted that operations employees hired from outside the community would move to the community, with their families (if applicable), and are expected to settle and become residents of the community. KAM also committed to supporting local businesses through procurement strategies that focus on local suppliers of goods and services to ensure that indirect job creation and economic benefits are retained in the community.

To help employment benefits accrue locally, KAM stated that it would support relevant local training programs through sponsorships, provision of used equipment to local training schools, and/or co-op placements for local trades students.

14.3.2 LOCAL TAX CONTRIBUTIONS OF THE PROJECT

Public comments stated that Ajax's tax contributions would be minimal, and expressed concern that there would be no municipal tax payments to the City of Kamloops. Some public comments and comments provided by SSN disputed the accuracy of the estimated tax contributions of Ajax described in the EIS/Application.

KAM responded that Ajax would be located predominantly on rural property, although small portions of it would be located within the City of Kamloops municipal boundaries, allowing for some limited direct collection by local tax authorities. KAM said properties outside of municipal boundaries in rural areas are administrated by regional districts, and pay property taxes to the Province. Consequently, KAM stated that Ajax would pay taxes to the Province that would later be distributed to the TNRD. KAM also stated that Ajax would contribute to federal and provincial taxes, and some portion of those contributions would be transferred to municipalities/regional districts as Community and Regional District Grants, which are allocations under programs governed by the Local Government Grants Act Regulation.

In response to comments regarding the accuracy of the estimated tax contributions, KAM stated that the analysis in the EIS/Application relied upon Statistics Canada's Input-Output model, which is considered a reliable source of information for multipliers that are used to estimate indirect and induced economic impacts at the provincial and national levels. At the local level, KAM used multipliers drawn from the BC Stats report entitled 'British Columbia Local Area Economic Dependencies'.

14.3.3 POTENTIAL ADVERSE EFFECTS ON EXISTING BUSINESSES

Public comments on Ajax's effects on business varied, with some suggesting there would be positive impacts on the local economy and others feeling strongly that there would be a net adverse effect. Some public comments expressed views that Ajax could create disincentives for businesses to locate to Kamloops should it result in adverse impacts to health care services, outdoor recreation, physician availability, and general perceptions of Kamloops' environmental sustainability. Some members of the public suggested that it would be difficult for local businesses to attract and retain employees, ultimately resulting in local business failure and/or relocation of businesses outside of Kamloops.

Some public commenters were of the view that Ajax would not be economically feasible, and that the represented risk to investors, governments, and the public were unacknowledged or understated.

SSN highlighted concerns about increased labour competition resulting in increased wage costs for employers. SSN questioned whether referring labour competition issues to the CLG, or pursuing joint recruitment initiatives, as proposed by KAM, would be effective in addressing effects. KAM responded that they are pursuing a business procurement plan that would assist in the development of SSN initiatives and a human resource strategy that would provide employment opportunities for local and regional First Nations. In addition, KAM noted that the City of Kamloops labour market already has experience in adapting to increased labour demands and that most businesses would be adept in handling the issue.

14.3.4 POTENTIAL ECONOMIC EFFECTS OF POPULATION OUT-MIGRATION

Some public commenters expressed concern that Ajax could result in out-migration of current residents from the City of Kamloops, resulting in adverse effects on the local economy including declines in real estate values and human capital.

KAM responded that Ajax is anticipated to result in up to 550 additional permanent residents in the early years of the operations phase. This includes skilled and educated workers, and their families, who would settle in the Kamloops area. KAM expects many of these families to buy homes, and as with existing residents, likely becoming active participants in the Kamloops community. KAM acknowledged that although some current residents have expressed the intention to leave the community if Ajax is developed, KAM considers this prospect to be highly uncertain and stated that it is unlikely that this would result in measurable and project-attributable changes in the size or composition of the population.

14.3.5 POTENTIAL ADVERSE EFFECTS TO LOCAL ECONOMIC DIVERSITY

Public commenters expressed concerns that an additional mine in the Kamloops area could be detrimental to economic diversification by increasing focus on the mining sector or by deterring other development initiatives. Furthermore, commenters expressed concern regarding loss of jobs and business opportunities in other industries, such as tourism, recreation, and education as a result of real or perceived environmental effects from Ajax.

KAM responded that Ajax is predicted to benefit business development initiatives in the Kamloops area and that the Project would positively contribute to economic diversification throughout Ajax's economic life through the creation of local employment, business, and partnerships.

With respect to tourism, potential adverse effects would be associated primarily with visual impacts and air quality. However, KAM noted that their air quality predictions show negligible effects for almost all areas of the City, and therefore KAM did not expect adverse effects on tourism activities.

To mitigate potential unforeseen impacts to the local economy, KAM proposed the formation of a CLG, which would provide a forum for discussion of on-going effects of Ajax and to identify opportunities for leveraging positive effects and partnerships.

14.3.6 KAM'S ESTIMATION OF ECONOMIC BENEFITS

The EAO notes that over the course of the review, members of the working group and the public raised concerns about the economic benefits of Ajax. Under the provincial *Environmental Assessment Act*, the EAO is responsible for assessing the potential significant adverse effects of Ajax, in consideration of practical measures to avoid and reduce adverse effects. The *Environmental Assessment Act* does not require assessment of economic feasibility or projected economic benefits.

Members of the public also raised concerns about adequate financial securities to mitigate risks associated with temporary or early closure. The EAO notes that financial securities are established in the *Mines Act* permitting process and are reviewed regularly.

SSN raised several concerns with the methods used in the EIS/Application to estimate potential impacts to SSN's Aboriginal economy, including:

- The absence of cost-benefit analysis that includes economic, environmental, and social risks associated with Ajax; and
- Lack of disclosure regarding detailed discounted cash flow information.

KAM questioned the feasibility and necessity of undertaking a cost-benefit analysis based on several factors, including data availability and difficulties measuring particular non-market values (e.g. cultural and spiritual values). KAM stated that instead, they focused on identifying areas of value to SSN and proposed measures to minimize or prevent effects on these areas to the extent possible, and that they proposed compensation measures for areas of importance to SSN where effects could not be avoided or fully mitigated.

SSN decided to undertake an assessment of economic benefits as a part of their own assessment process, and further information is found in section 24 of this Report.

In regards to SSN's concern with the lack of disclosure of detailed cash flow information, KAM stated that providing spreadsheets of cash flow calculations is not part of any public disclosure requirements or industry best practices and that is not uncommon to display cash flow estimates in graphical displays. KAM also stated that SSN was engaged through confidential discussions to discuss the economics of Ajax.

14.4 ANALYSIS AND CONCLUSIONS OF THE EAO

Overall, based on input from EA participants, including the working group, the information provided by KAM, and in consideration of applicable mitigation measures, the EAO is of the view that there would be no adverse project effects to the following economic valued components:

- Economic growth, labour force, employment and training;
- Income;
- Business; and
- Economic diversification.

14.4.1 LABOUR COMPETITION

After considering EA participant input, information provided by KAM including proposed mitigation measures, the EAO concludes that there could be residual effects from labour competition during construction and, to a lesser extent, operations.

The demand for construction labour force for Ajax could reduce availability and increase wage pressure for skilled labour. These effects are expected to be short lived as continued population growth should provide sufficient additional labour, and therefore are likely to decline during operations. In addition, the increased labour costs for local businesses may be offset by increased business revenue from growth in local and regional economic activity related to the construction phase and to a lesser extent the operations phase. To help better understand and respond to potential residual labour competition effects, the EAO is proposing an EA Certificate condition that would require KAM to report on local and regional training, employment and procurement.

The EAO concludes that the potential adverse effect to labour competition is considered low in magnitude and would apply only to the regional Kamloops economy. Labour competition effects would be most pronounced during the construction phase but could occur during the initial years of operations. Labour competition effects are expected to be continuous (with the potential for infrequent acute episodes) and would be reversible upon closure of the mine. The likelihood that Ajax would result in some form of labour competition is moderate due to the high wages that are typically offered by industrial projects and proximity to the City of Kamloops. There is a moderate level of confidence due to challenges in predicting a range of variables including the circumstances under which an individual may leave their current place of work for an employment opportunity with Ajax.

The EAO's characterization of the residual effects of Ajax on local and regional economy, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

14.4.2 CUMULATIVE EFFECTS

The EAO is of the view that past, present and future projects and activities, including the TMX and the proposed Harper Creek Mine Project could contribute to cumulative effects. Contributions from past and present activities were measured by KAM in its description of baseline conditions for economic growth, labour force, employment and training, income, business, and economic diversification valued components. In this manner, the effects of projects and activities that have been carried out are reflected in the existing baseline conditions and have informed the identification and analysis of the residual labour competition effects discussed above.

The EAO is of the view that should concurrent construction of the Harper Creek mine expansion and TMX development occur, it could add to baseline labour demand resulting in increased wage pressures for small and medium sized businesses in Kamloops and the TNRD. The additive effect of these future developments, in combination with the residual effects of Ajax, could result in a cumulative labour competition effect in the local and regional study areas. The EAO is of the opinion that the overall cumulative labour competition effect would be medium in magnitude as immigration of workers, stimulated by the projects, may be insufficient to meet short term regional labour market demands. The EAO expects the cumulative labour competition effects to subside as the projects move from construction to operation. The EAO notes that although labour competition has the potential to negatively affect local and regional businesses, the impacts may be offset by increased revenue.

14.4.3 CONCLUSION

Considering the above assessment and having regard to the implementation of applicable mitigation measures proposed by KAM and the Provincial conditions identified in the table of conditions and the Certified Project Description (which would become legally binding in the event that an EA Certificate is issued), the EAO is of the view that Ajax is not likely to cause significant adverse effects on labour competition, or to the other economic valued components assessed in this section.

Taking into account the implementation of applicable human resource management measures proposed by KAM and the proposed EA Certificate conditions, the EAO concludes that Ajax, in combination with past, present, and reasonably foreseeable projects, is not likely to result in significant adverse cumulative effects from labour competition.

15 Land and Resource Use

15.1 BACKGROUND

This section provides the assessment of the potential effects of Ajax on other land and resource use. The land and resource use valued component was selected because of the potential for existing land uses such as residential development, farming and ranching, and forestry to be impacted during Ajax construction, operations, and decommissioning phases. The EAO's assessment of project effects on property values is in section 16 of this Report.

Ajax is located adjacent to and south of the City of Kamloops, within the TNRD, an area in the BC interior that includes both urban and rural landscapes. Current land and resource use in and around the mine site is predominantly associated with ranching. Other land uses in the vicinity of Ajax include forestry, mining, and recreation.

The proposed site for Ajax is within an area SSN knows as *Pípsell* and over which SSN asserts Aboriginal title. Through the SSN Assessment Process (see section 24.3), SSN has declared an end land use objective for this area and has stated that Ajax would not be compatible with this objective.[56] Potential impacts of Ajax on SSN's asserted Aboriginal title are assessed in section 24.4.2.

15.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

KAM's assessment of Ajax's potential effects to the land and resource use valued component is presented below, along with relevant mitigation measures.

15.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

The EIS/Application characterized the land and resource uses that could be impacted by the mine components and activities. To assess effects from Ajax, including establishing the assessment baseline on the land and resource use, KAM engaged with neighbouring ranchers, City of Kamloops planning staff, the public and concerned user groups, and consulted with SSN. The following three themes were used to characterize the baseline for land and resource use: [1] land management and planning; [2] ranching and agriculture; and [3] agricultural water use.

15.2.1.1 *Land Management and Planning*

KAM noted that approximately 87% of the project footprint would be located on private land owned by KAM and approximately 13% would be located on Crown land. Land and resource use around the Ajax footprint is administered by either the City of Kamloops, the TNRD, or by the Province. At full build out, Ajax would be approximately 800m south of the Kamloops city boundary. There is no city development currently located in this area.

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[56] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pípsell*

The EIS/Application assessed the potential impacts of Ajax on the integrity of planning objectives and land use designations under the City of Kamloops official community plan 'KAMPLAN', the TNRD South Kamloops Official Community Plan, the provincial land and resource management plan. KAM also evaluated project effects on land designated as Agricultural Land Reserve (ALR) under the *Agricultural Land Act.*

15.2.1.2 *Ranching and Agriculture*

Cattle ranching is the primary agricultural activity in the region. Of the 58 farms within the local study area, 28 are classified as cattle ranching and farming and 16 are classified as other animal production. Sugarloaf Ranch, which is owned by KAM, is the largest ranch in proximity to Ajax.

15.2.1.3 *Agricultural Water Use*

Ranching activities rely on water obtained through existing surface water licences to Peterson Creek. The licenced volumes were considered in KAM's baseline water balance model and have been considered in the assessment of potential impacts to surface water quality and quantity below.

15.2.2 POTENTIAL EFFECTS AND MITIGATION MEASURES

KAM focused its assessment of the effects to the land and resource use valued component on three key indicators and the degree to which project construction and operations could:

- Impact the ability of local and regional governments to meet their land use objectives;
- Impact current regional district and provincial land use designations; and
- Affect ranching, including access to grazing lands and agricultural water use.

The EIS/Application indicates that Ajax has the potential for impacts to future land use planning, residential development, and related recreational activities. KAM reported that construction and operations would alter current land uses inside the mine site. Project construction and operations could adversely affect surrounding land uses through noise, dust, and limitations on access.

The EIS/Application reports that approximately 1,300 hectares of Ajax lands (approximately 80% of the project area) are presently zoned as ALR. Under the ALR designation, resource uses such as oil and gas, forestry, aggregate extraction, and mineral development may be allowed contingent on approval by the Agricultural Land Commission (ALC). KAM has indicated its intent to apply to the ALC for a non-farm use approval and for permanent exclusion of the open pit area from the ALR should Ajax receive an EA Certificate.

Ranching activities may be affected through changes in dust, noise and vibration, physical access to grazing fields, and access to sufficient water quantities to support ranching operations. The closure of Goose Lake Road would affect one rancher's access to grazing lands during construction and operations; KAM has committed to developing an access agreement with the landowner. Overall, KAM states that effects to ranching during construction and operations would primarily affect Sugarloaf Ranch, which is owned by KAM. Following closure and reclamation, KAM committed to return all lands to their former agricultural capacity and to progressively grant access to grazing lands within the Ajax footprint. The open pit would not be reclaimed.

KAM assessed project effects on access to water for agriculture. During construction and operations, prior to mitigation, Ajax would reduce peak flows in Peterson Creek which could have potential effects to holders of water licences for irrigation/agricultural use. Water quantity may also be affected during the decommissioning, closure, and post closure phases, as reclamation activities to the mine rock storage facility may reduce stream flows in Peterson Creek for agricultural use. Further details on surface water quantity and quality effects and mitigation measures are provided in section 2 of this Report.

Four wells, three of which are used for irrigation, are reported to exist within 2 km of the open pit and would potentially need to be relocated or deepened, as KAM predicted that groundwater elevations would be approximately 100 meters lower post-closure, compared to existing conditions.

The EIS/Application identified the following key proposed mitigation measures to address effects on the land use planning objectives and land use designations of City of Kamloops and TNRD:

- Implement a noise and vibration management plan, including a blasting management plan, to reduce perceptible noise and vibration effects within the City of Kamloops, and in particular, in nearby residential neighbourhoods; and
- Convene a CLG made up of Ajax stakeholders to provide input into monitoring plans, help monitor activities and results and identify and address community concerns, where feasible, as Ajax shifts from licensing to construction and operations.

In the EIS/Application, KAM proposed the following mitigations for impacts to ranching practices:

- Implement an access management plan that allows for limited access for ranchers to available grazing areas; conduct annual meetings between KAM and local area ranchers to coordinate management practices; and, discuss adaptive management approaches to enhance ranching activities where safe to do so;
- Negotiate agreements with nearby ranchers to acquire private lands or other use rights; and
- At closure, reclaim and restore the land (except the mine pit) to a rangelands standard suitable for agricultural and other land uses, as required by the *Mines Act*, and using native plant species.

KAM proposed the following mitigations to address potential impacts to surface and ground water sources used for irrigation and livestock watering needs:

- Implement a fugitive dust management plan to reduce potential water quality impacts from emissions from the haul roads and other emission sources;
- Reduce the magnitude of impacts to surface water flow in Peterson Creek, particularly for downstream water users, by supplementing with water pumped from Kamloops Lake during the Operations phase; and
- Deepen or relocate groundwater supply wells within 2 km of the open pit as necessary to mitigate the effects of the pit lake on these wells (i.e. the drawdown of the water level in the well).

15.2.3 CUMULATIVE EFFECTS

The EIS/Application included an assessment of cumulative effects on the ability of local and regional governments to achieve their land use planning objectives. KAM reported that TMX has the potential to interact with land and resource use and the project effects. However, KAM states that any potential cumulative effects are likely to be short term and result in only minimal aesthetic alterations to the landscape and thus would not result in any material incremental cumulative effects to land and resource use.

15.2.4 MONITORING AND FOLLOW-UP

KAM committed to a series of air quality, water quality and quantity, vegetation, noise and vibration, and fugitive dust management plans, each of which includes monitoring commitments for the respective impacts. The CLG is intended to act as a forum to review the ongoing monitoring results from Ajax.

15.3 DISCUSSION OF ISSUES

During the EA, members of the working group and the public raised concerns related to the potential effects of Ajax on land and resource use. This section provides a summary of the key issues raised and KAM's responses.

15.3.1 EFFECTS ON ACHIEVING LAND USE PLANNING OBJECTIVES UNDER KAMPLAN

The City of Kamloops identified concerns about the potential impacts to achieving their land use planning objectives and in particular, implications for recent investments in planning and infrastructure development in south west Aberdeen. The City of Kamloops further indicated it could incur financial losses from a decline in land values and that it is incumbent on KAM to provide details on alternative growth areas in response.

Aberdeen Highlands Development Corporation, a major land holder and developer in the Southwest Sector of Kamloops and member of the Community Advisory Group, expressed concern that approximately 48% of future residential development in Aberdeen is slated to occur within 1 km and up to 800 m from the Ajax boundary. As such, Aberdeen Highlands Development Corporation petitioned KAM for financial compensation to affected parties.

In response to these concerns, KAM acknowledged that potential nuisance effects (noise, vibrations, dust, traffic, and reductions to dark sky) could result in (real or perceived) residual effects to future residential development in areas adjacent to Ajax. KAM stated that their monitoring results for nuisance factors would be shared with a CLG which would act as a forum to express, evaluate, and further address land and resource use issues that arise during all project phases. KAM also said that the City of Kamloops and TNRD have the capacity to identify new growth areas and amend the official community plans in the event that current future growth areas are deemed undesirable. Through the implementation of mitigation measures, KAM is of the view that the potential for negative perceptions of the neighbourhoods of south Kamloops would reduce over time. On this basis, KAM does not anticipate that Ajax would require the City of Kamloops to consider alternative areas for future development. KAM disagreed that a property value compensation plan was necessary, as requested by Aberdeen Highlands Development Corporation and the ANA.

15.3.2 EFFECTS ON ACCESS TO GRAZING LANDS

Members of the public expressed concern that Ajax would prohibit cattle grazing on range lands within the project footprint for the duration of Ajax. In addition, some commenters said that the anticipated closure of Goose Lake Road and changes to access for ranchers to grazing fields on the periphery of Ajax would further restrict or remove access to grazing lands for some ranchers.

KAM responded that only one rancher would be directly affected by the closure of Goose Lake Road and this individual would be provided alternative access arrangements. Similarly, KAM noted that agreements with nearby ranchers to acquire private lands and other arrangements would mitigate access impacts to local ranchers.

15.3.3 EFFECTS OF DUSTFALL ON FORAGE QUALITY AND LIVESTOCK WATERING

The Kamloops Food Policy Council commented about the potential for direct exposure to dustfall on livestock or through inhalation and ingestion of contaminated plant forage. KAM stated that the levels of contaminants of concern expected during construction and operations would not exceed the tolerance thresholds for livestock. KAM committed to monitor dust deposition to detect changes in metal or other mineral concentrations in vegetation and soil to ensure the safety of ranching operations in the area. KAM added that they would collaborate with local ranchers to establish appropriate monitoring programs. See section 8 for additional information related to dustfall impacts and mitigation measures.

MOE and the Lower Nicola Indian Band raised concerns about the potential for molybdenum to affect surface water quality for wildlife and livestock watering, which could impact the quality of harvested foods. KAM committed to monitoring metal concentrations in water, soil, and vegetation as part of on-going environmental effects monitoring and indicated that this information would be used to verify the exposure predictions contained in the human health and ecological risk assessment. See section 2 for additional information related to surface water quality effects and mitigation measures.

Additional issues related to baseline sulphate concentrations and manganese concentrations effects on irrigation raised by the City of Kamloops are addressed in section 3 of this Report.

15.3.4 EFFECTS TO WATER QUANTITY FOR IRRIGATION

During review, the Kamloops Food Policy Council and MFLNR raised concerns about related effects on licenced agricultural surface water users who divert stream flows to irrigate fields for hay production, livestock grazing, as well as water consumption by their livestock. In response, KAM provided additional information regarding the potential impacts to existing licence holders and indicated that Ajax could potentially affect licence holders upstream and downstream of Jacko Lake. KAM indicated that, under 5-year dry conditions, there would be insufficient water for the four upstream licences, since their use of water is third in priority. These four licences total 530,000 m^3 annually for irrigation purposes. KAM proposed mitigation for the predicted flow reductions that included augmenting flow in Peterson Creek with water from Kamloops Lake. KAM stated that pumping water from Kamloops Lake was a conceptually feasible approach for the construction, operations and decommissioning and closure phases, but that a long-term solution would be required for the post-closure phase. KAM committed to ensuring that water supply in Peterson Creek would be maintained for water licence holders with higher priority than KAM at post-closure and would continue to pump from Kamloops Lake until an alternate long-term solution was in place. KAM also stated they would work with water licence holders and MFLNR to amend their licences so that there would be no change in the timing or quantity of water allocation.

KAM noted that the existing water licence holders would not be affected in all years. In years with above average precipitation, there would be sufficient runoff to Jacko Lake to meet all licence requirements, even with the predicted reduction in streamflow from Ajax. Historically, there is insufficient runoff to meet downstream demands about 20% of the time (which corresponds to 5-year dry conditions).

In response to regulator concerns about the long term impacts to surface water licence holders, KAM committed to ensuring that water supply in Peterson Creek would be maintained for water licence holders with higher priority than KAM post-closure. According to KAM, this would require a combination of Keynes and Humphrey Creek diversions and/or a transfer of water rights. KAM noted that, at a minimum, post-closure mitigation would include continuing augmentation from Kamloops Lake until a suitable alternative could be established, based on the status of water licences and streamflow conditions at the time of closure. In follow-up, MFLNR recommended that KAM be required to provide a conceptually feasible solution, prior to the commencement of construction, that does not involve continued pumping from Kamloops Lake and that could ensure that Ajax would not affect existing water licence holders during post-closure.

The working group noted there are existing registered groundwater wells and groundwater licence holders in the vicinity of Ajax who could be impacted by Ajax. Four registered groundwater wells are known to be located within the radius of potential groundwater impacts, and include one private/domestic well and three commercial/industrial wells. KAM indicated that, should Ajax cause a decrease in productivity of groundwater wells, additional mitigation measures would be applied, such as relocating or deepening the well to meet the water supply demand.

15.4 ANALYSIS AND CONCLUSIONS OF THE EAO

After considering relevant proposed mitigation measures, the EAO concludes that Ajax would result in residual adverse effects on land and resource use. The EAO's characterisation of the potential residual effects of Ajax on land and resource use, as well as the EAO's level of confidence in the effects determination, is summarized below.

15.4.1 *LIMITATIONS ON ABILITY OF LOCAL GOVERNMENT TO ACHIEVE LAND USE PLANNING OBJECTIVES*

The EAO notes that Ajax, with the exception of portions of the powerline and water intake pipes on the shores of Kamloops Lake, lies outside of the City of Kamloops boundaries and thus would not physically alter the lands identified in KAMPLAN. The EAO is of the view that the future development in the southwest area of the City of Kamloops near the Ajax boundary could be affected by the proximity of Ajax, as those areas could experience periodic increases in noise and a potential for reduced air quality and visible dust deposition effects in Aberdeen on certain days and under specific climatic conditions. The EAO acknowledges uncertainties associated with the compatibility of effects from Ajax and future residential development closer to the City boundary, although also notes that no developments are currently proposed for this area. The EAO acknowledges the concerns raised by the City of Kamloops and the TNRD that public perception may also affect the desirability of these areas. To help address potential impacts to the City's land use plans that are related to development adjacent to Ajax, should they arise, the EAO has proposed EA Certificate conditions to manage dust, noise, and light pollution in previous sections of this report.

The EAO concludes, with consideration for KAM's stated commitments and the proposed EA Certificate conditions, that residual impacts to the ability of local government to achieve their land use planning objectives would be low magnitude. Constraints to achieving community land use objectives would occur continuously for City lands adjacent to Ajax and would dissipate with distance from the mine. These effects would highest during operations and would be reversed at closure. The EAO considers the likelihood of effect as moderate given the community's stated concerns about the mine impacts and the uncertainty about how residents and prospective residents of Kamloops might respond to the real and/or perceived impacts to land and resource use near the mine site.

15.4.2 EFFECTS ON RANCHING PRACTICES AND ACCESS TO GRAZING LANDS

The EAO is of the view that Ajax could adversely affect ranching practices and access to grazing lands. The EAO understands that KAM, as the owner of the Sugar Loaf Ranch, has interests in maintaining commercial cattle operations, including the access agreements typically negotiated on an informal basis between neighbouring ranches. The EAO acknowledges KAM's intentions to maintain access to grazing lands through agreements with neighbouring ranches and to restore grazing lands after project closure. The EAO is proposing an EA Certificate condition requiring KAM to provide ranchers who would be affected by a partial closure of Goose Lake Road with alternative means of access to move cattle and personnel between grazing areas and their properties.

The EAO accepts KAM's conclusion that Ajax is unlikely to adversely affect the quality of ungulate forage as a result of dust deposition, and notes KAM's commitment to monitor plant tissue as part of the on-going monitoring program over the life of Ajax. The EAO also notes there are requirements under the *Environmental Management Act* for ecological monitoring and management. The EAO agrees with KAM's commitment to develop and implement grasslands restoration and offsetting during the life of Ajax. The EAO proposes that this plan be an EA Certificate condition.

The EAO concludes, with consideration for KAM's commitments and the proposed EA Certificate conditions, that the magnitude of impacts to ranching practices is low given that KAM is committed to negotiating access agreements with neighboring ranches. Effects would extend to adjacent ranches to Ajax, would occur at regular intervals depending on the ranchers need for forage, and would be reversible following decommissioning and closure (perhaps earlier in some cases where progressive reclamation allows). Given the proposed closure of Goose Lake Road there is a high likelihood of effect.

15.4.3 IMPACTS TO LICENCED AGRICULTURAL WATER USERS

The EAO is of the view that Ajax would impact the availability of water for certain licenced agricultural water users in the vicinity of Ajax. The EAO is of the view that impacts to the four groundwater licensees would be reduced or avoided through KAM's proposed mitigation to deepen the affected wells. To ensure appropriate mitigations are applied to the affected groundwater licence holders, the EAO is proposing a groundwater management condition that would include a requirement that KAM ensure access to groundwater for the affected licensees.

For surface water licences located downstream of Ajax on Peterson Creek, the EAO notes that KAM has committed to continuing to pump water from Kamloops Lake to maintain baseline streamflow levels until an alternate long-term solution is in place, which would mitigate effects to surface water licence holders downstream of Ajax. Upstream of Ajax, the EAO notes that four surface water licences would have insufficient water for irrigation during low flow periods; however, the EAO also notes that there is sometimes insufficient water for these licence holders in low flow periods under existing conditions. To address uncertainties related to the predicted streamflow reductions and related effects on surface water licence holders, the EAO is proposing an EA Certificate condition that would require KAM to develop a long-term streamflow management plan to address effects to surface water licence holders upstream and downstream of Ajax. The four surface water licences upstream of Jacko Lake may have moderate magnitude effects, given the potential for reduced surface water levels that would potentially be inadequate for their irrigation needs. The effect would occur sporadically depending on seasonal precipitation rates at the affected properties and would not be reversible following closure and decommissioning. The likelihood of effect is moderate given KAM's anticipated mitigations and the EAO's proposed EA Certificate conditions.

The EAO's characterization of the residual effects of Ajax on land and resource use, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

15.4.4 CUMULATIVE EFFECTS

The EAO considers KAM's assessment of potential cumulative residual effects to the ability of local and regional governments to achieve their land use planning objectives to be adequate. In consideration of existing and reasonably foreseeable projects and activities that have the potential to act cumulatively with Ajax on ranching practices, the EAO considered potential project interactions between Ajax and TMX. It is the EAO's perspective that, should TMX and Ajax be constructed concurrently, the impacts to ranchers' access to grazing lands would not likely change materially from the effects of them being developed at differing times with no overlap. Refer to section 2 of the Report for the Agency and EAO's assessment of cumulative effects to surface water quantity.

15.4.5 CONCLUSION

Considering the above analysis and having regard to the proposed conditions identified in the Table of Conditions, and the Certified Project Description (which would become legally binding as schedules of an EA Certificate), the EAO is satisfied that Ajax would not have significant adverse effects on land and resource use.

16 Property Values

16.1 BACKGROUND

This section assesses the potential adverse effects of Ajax on property values inclusive of residential, commercial, industrial, and agricultural properties. Ajax effects on land and resource use, including agricultural practices at the individual property level, are assessed in section 15 of this Report.

KAM's assessment approach evaluated how project-attributable "nuisance factors" (effects to air quality, noise and vibration, visual aesthetic qualities) and perceptions of these effects could adversely affect property values in the study area. For this section, the EAO also considered the information regarding potential effects as outlined in the EIS/Application sections on noise and vibration, human health, air quality, visual quality, and dark sky.

16.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

16.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

KAM's EIS/Application cited information from the BC Real Estate Association that indicated the current residential housing stock has been sufficient and balanced in the City of Kamloops from 2013 to 2015, resulting in relatively stable home prices during this period. KAM also noted that the CMHC reported that the vacancy rate in Kamloops for rental apartments with three or more units was 5.1% as of April 2014, which was higher than the provincial average. KAM noted that in-migration of new workers during operations has the potential to result in an increase in residential property values. KAM considered that increasing property values could increase housing unit rents, potentially affecting the availability of affordable housing for some vulnerable households.

16.2.2 POTENTIAL EFFECTS AND MITIGATION MEASURES

The EIS/Application described a number of factors that affect property markets and the complexities of attributing changes in property values to Ajax nuisance effects. These studies indicate that city-wide, Ajax would result in very limited changes from current conditions during construction and operations. This finding includes the neighbourhoods of Pineview Valley and Upper Sahali as well as parts of Aberdeen and Knutsford (locations of Kamloops neighbourhoods are illustrated in Figure 7 below).

KAM concluded that the rural residences closest to Ajax would be most affected by nuisance effects that could exert downward pressure on property values. KAM noted that residences in Knutsford and in Aberdeen may also experience Project nuisance effects, such as lower air quality, noise and vibration, and aesthetic changes that could put downward pressure on residential property values. KAM also stated that some public apprehension of larger-than-predicted nuisance effects may have short term adverse effects on property values, particularly in neighbourhoods closest to the Project at various stages of project development. KAM's assessment of residential properties applies broadly to the agricultural properties under study; however, effects on agricultural practices and productivity were not considered as a component under KAM's property value assessment.

The closest area to Ajax zoned for commercial use is approximately 3 km north of the mine site. Due to the distance from Ajax, KAM concluded it is unlikely these industrial locations would experience nuisance effects at a level that would result in lowered real estate value.

KAM reported that the impact of nuisance effects to property values are highly uncertain given the multitude of factors that contribute to property values. KAM stated that the best way to mitigate impacts to property values would be to address the nuisance factors that may affect it. According to KAM, this included the implementation of project design and best management practices for air quality, noise and vibration, visual impacts and aesthetic features. KAM noted that the following management plans would directly or indirectly address impacts of nuisance effects on residential and/or agricultural property values during construction and operations:

- Dust control plan and fugitive dust management plan;
- Noise and vibration management plan;
- Air quality monitoring plan;
- Ranch management plan; and
- Access management plan.

KAM stated that the nuisance effects on property values would reduce or cease during the decommissioning and closure phases.

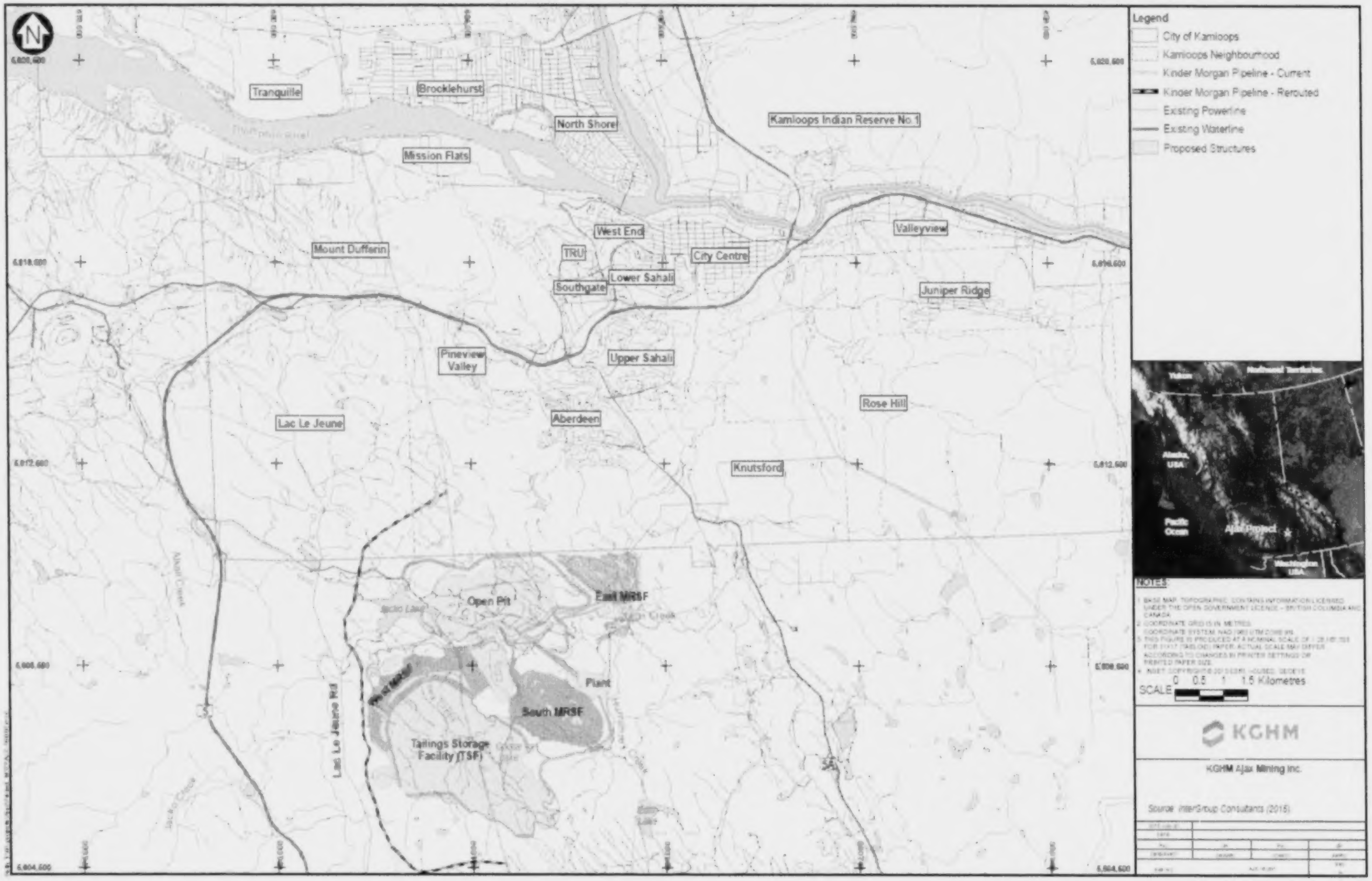
16.2.3 CUMULATIVE EFFECTS

KAM identified the TMX as a potential cumulative effect with Ajax to agricultural property values. However, due to the uncertainties described above regarding the various factors influencing property values, and the relatively short duration of the TMX, KAM considers a measurable cumulative effect to agricultural property values unlikely.

16.2.4 MONITORING AND FOLLOW-UP

To complement the management plans above, KAM proposed to monitor Ajax nuisance effects that could potentially influence a change in property values, during construction and operations. KAM committed to share these monitoring results through engagement and information sharing mechanisms, such as the Community Liaison Group.

Figure 7: Kamloops Neighbourhoods and City Development Boundary


Tranquille
Brocklehurst
North Shore
Mission Flats
Kamloops Indian Reserve No.1
West End
TRU
City Centre
Lower Sahali
Southgate
Valleyview
Juniper Ridge
Mount Dufferin
Pineview Valley
Upper Sahali
Aberdeen
Rose Hill
Lac Le Jeune
Knutsford
Open Pit
East MRSF
Plant
South MRSF
Tailings Storage Facility (TSF)
Lac Le Jeune Rd
Legend
City of Kamloops
Kamloops Neighbourhood
Kinder Morgan Pipeline - Current
Kinder Morgan Pipeline - Rerouted
Existing Powerline
Existing Waterline
Proposed Structures
Pacific Ocean
Ajax Project
Washington USA
Alaska USA
Yukon
Northwest Territories
NOTES:
1. BASE MAP: TOPOGRAPHIC. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE – BRITISH COLUMBIA AND CANADA.
2. COORDINATE GRID IS IN METRES.
COORDINATE SYSTEM: NAD (83) UTM ZONE 10.
3. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:25,000 FOR 11X17 (TABLOID) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.
4. INSET COPYRIGHT © 2013 ESRI. USED.
SCALE 0 0.5 1 1.5 Kilometres
KGHM
KGHM Ajax Mining Inc.
Source: InterGroup Consultants (2015)
5,820,600
5,816,600
5,812,600
5,808,600
5,804,600

Source: EIS/Application – Figure 7.5-2

16.3 DISCUSSION OF ISSUES

During the EA, working group members, the City of Kamloops, property developers, Indigenous groups, and the public raised a number of issues related to concerns about project effects to property values. The key issues raised during the EA included:

- Concerns about KAM's assessment approach for property value impacts in the EIS/Application;
- Requests for KAM to develop a property value protection program; and
- Impacts of changes to dark sky at night on property values.

16.3.1 KAM'S ASSESSMENT APPROACH FOR PROPERTY VALUE IMPACTS IN THE EIS/APPLICATION

During the EA, the City of Kamloops and SSN commented that the probability of Ajax resulting in effects to residential property values is uncertain and that their confidence in the analysis was low because of uncertainties associated with the air quality, noise assessments, and future development.

Members of the ANA and staff of the Aberdeen Highlands Development Corporation raised concerns about KAM's qualitative approach to assessing impacts to property values and argued that a quantitative approach was warranted. KAM responded that they had evaluated a number of alternative methods to assess potential impacts to property values, including hedonic pricing[57] as suggested by concerned stakeholders. KAM acknowledged the value of quantitative methods to understand the issue; however, they noted that the data required for a more quantitative analysis are unavailable for the Aberdeen area. Irrespective of data availability, KAM noted that it is theoretically challenging to consistently and rigorously account for all attributes that contribute to property values. KAM stated that the numerous uncertainties inherent in a quantitative approach would not provide increased confidence in the property value assessment.

In response to issues raised by the City of Kamloops, SSN, and others, the EAO required KAM to better characterize the magnitude and extent of the potential effects of nuisance factors. KAM was required to provide additional information on the number of residences that might be discernibly affected by project nuisance factors according to the technical studies and modelling undertaken for the EIS/Application. The EAO also required KAM to provide an indication of whether the value of any of those properties may have particular sensitivity to any of the nuisance factors. Additionally, the EAO required that KAM provide information on potential effects of noise emissions at key receptors. In response to the EAO's request, KAM provided a memo describing the number of existing residential properties potentially affected by nuisance factors associated with Ajax. KAM also conducted subsequent additional air quality modelling and maximum noise modelling at the EAO's request and this information is included in the summary of results below.

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[57] Hedonic pricing methods or models can be used to estimate economic values for ecosystem or environmental services, neighbourhood amenities or dis-amenities, or property specific attributes that directly affect market prices for real property. Hedonic pricing models for property valuations are based on identifying value influencing attributes of a set of properties of known value, and attempting to value the contribution of each attribute to the overall value of individual properties. Large volumes of data on property values and property attributes are typically required to build a robust model capable of estimating the economic value of individual property attributes or locational influences.

KAM estimated that during construction:

- Up to 10 rural residential properties near the eastern and western portions of Ajax could experience noise events that would be perceptible above the baseline; and
- No residences would be affected by changes in air quality.

KAM estimated that during operations:

- Up to 22 residential properties near the eastern and western portions of the project would experience perceptible noise and dust events, and/or visual impacts and that most of these properties (21) would have a line of sight to the mine area and would experience various levels of progressive impacts to visual quality throughout the operations phase;
- Up to 183 residential properties in Aberdeen may experience dust events up to one day per year related to 24hr TSP;
- For 24hr PM_{10} concentrations under a 90% dust mitigation scenario, KAM stated up to 777 residential properties in Aberdeen could experience exceedances of air quality objectives effects for up to 7 days per year depending on distance from the mine site boundary;
- 24-hour $PM_{2.5}$ concentration would exceed the applicable regulatory thresholds at the mine boundary 3 days per year; but would not exceed thresholds at any residences; and
- Progressive impacts to visual quality for properties with a line of sight of the mine area.

KAM noted that effects to property values are generally associated with changes that are visible/perceptible at the property. The majority of measurable/noticeable changes during operations are expected to occur in close proximity to Ajax, most notably for rural properties near the eastern and western mine site perimeters where noise from the site may be perceptible at times, and where the residents may have varying views of the mine site. KAM stated that effects in the Aberdeen neighbourhood, if they occur, would likely be based on risk perceptions rather than perceptible nuisance factors related to Ajax.

16.3.2 Requests for KAM to Develop a Property Value Protection Program

The City of Kamloops, the ANA, and the Aberdeen Highlands Development Corporation requested that KAM undertake a property value protection program and sought further information regarding adaptive management approaches related to a potential change in property values due to Ajax. In response, KAM described the challenging nature of directly attributing a potential change in property values to Ajax. KAM noted that the best way to mitigate potential effects on property values is to effectively mitigate and monitor the nuisance factors that could influence property values. KAM said that a CLG would be established to review monitoring results from the proposed air quality and noise and vibration monitoring programs (among other tasks), and that if monitoring demonstrates unforeseen project related nuisance effects are occurring, KAM would work with the CLG to develop adaptive management strategies. The City of Kamloops and local stakeholder groups stated that they consider this issue as unresolved.

16.3.3 *IMPACTS OF CHANGES TO DARK SKY AT NIGHT ON PROPERTY VALUES*

The City of Kamloops raised concerns about the potential impacts to property values from increased artificial light at night (ALAN) from Ajax. The City of Kamloops requested a quantitative study of ALAN including detailed mitigation measures for any assessed residual effects. KAM's revised ALAN assessment method was considered adequate to understand general impacts to sky glow in the potentially affected neighbourhoods surrounding the project footprint. KAM stated that the inhabited areas of Kamloops would not experience an increase in sky glow, with the possible exception of Knutsford. KAM committed to mitigate dark sky effects, in part, through a light pollution management and monitoring plan, updating baseline data on dark sky effects through engagement with the Kamloops Astronomical Society and local residents, and ultimately through convening the CLG as a means of ensuring regular two-way communication with the stakeholders in the community. The City of Kamloops maintains they consider the effects associated with light pollution to be highly uncertain.

16.4 ANALYSIS AND CONCLUSIONS OF THE EAO

16.4.1 *PROPERTY VALUES*

In consideration of technical advice regarding the complexity of multiple factors that influence property values, the EAO acknowledges the challenges of attribution of property value impacts related to any single project or activity including Ajax. The EAO is of the view that most properties in the City of Kamloops are unlikely to be exposed to nuisance factors at levels that would result in long term downward pressure on property values. The EAO notes that although changes to air quality may occur, depending on the criteria in question and the climatic conditions of the day, overall incidences of criteria air contaminants would remain below regulatory thresholds most of the time. Based on the analysis in section 9 of this Report, noise effects, although occasionally audible above background levels, are predicted to remain largely unnoticeable in most scenarios at most receptors. Vibration effects are estimated to be below the level of human detection for most events at most receptors outside of the Ajax boundary. On rare occasions, under certain climatic conditions, air overpressure effects from once-daily blasting may be perceptible at residences nearest to the open pit.

Overall, in consideration of the nuisance factor effects at the neighbourhood scale (Aberdeen, Pine View Valley, Upper Sahali, Lac Le Juene, and Knutsford), the EAO is of the view that if dust and noise issues create a noticeable effect in these areas, this could exert downward pressure on local property values relative to the rest of the city. In consideration of the assessment of noise, air quality and visual impacts in this Report, the EAO considers that the magnitude of these effects would range from negligible for most properties in the southern reaches of the city to low magnitude for a limited number of Aberdeen properties near the southern border of the city.

The EAO notes there would be the potential for a small number of properties (<22) located in the rural areas surrounding the project, to experience individual nuisance factors or the compounded effects of multiple nuisance factors such that there could be downward pressure on their property value. During construction, up to ten residential properties would have the potential to experience noise-related disturbance. During operations, based on information provided by KAM, the EAO anticipates that mine activities could result in the following nuisance factor effects:

- 9 residential properties experiencing a combination of dust, visual, and noise effects;
- 1 residential property experiencing dust and noise effects;
- 6 residential properties experiencing visual and noise effects; and
- 6 residential properties experiencing only visual effects.

If maximum noise levels predicted by KAM are realized, the residents nearest the east and west project boundary could potentially experience sleep disruption related to trucks operating on the haul roads and mine rock storage facilities when these activities occur in proximity to the properties in question.

To reduce potential nuisance effects on property values, the EAO has proposed EA Certificate conditions requiring that KAM:

- Not exceed noise levels that can potentially result in sleep disturbance;
- Not exceed day time noise guidance thresholds as outlined by Health Canada and the BC Oil and Gas Commission
- Constrain blasting vibrations below human thresholds for annoyance (and consequently well below thresholds for impacts to structures); and
- Implement an air quality management plan including fugitive dust mitigations.

The EAO concludes that Ajax could exert up to medium magnitude downward pressure on the value of some rural properties near or adjacent to the mine site, depending on the number and severity of overlapping nuisance factors that may be experienced during operations. The EAO concludes that Ajax may exert downward pressure on Aberdeen property values, but the magnitude of this effect would be negligible to low depending on the proximity of the property to the mine site and its relation to prevailing wind directions which influence dust deposition and noise emissions. The frequency of nuisance effects would be continuous, local in extent (limited to properties near to the mine), and largely reversible following reclamation. The likelihood of downward pressure on property values at 2-3 rural residential properties is high due to their close proximity and aspect with the mine; the likelihood for other properties ranges from low to moderate depending on their proximity to the mine. The EAO also notes that Ajax may exert upward pressure on property values in the region due to project related population increases and income effects, which could temper project effects on property values.

Taking into consideration input from property valuation experts regarding the complexities of ascribing changes in property values to Ajax, the EAO is of the opinion that a property value protection program, as requested by some commenters during the EA, is not appropriate. Overall, the EAO considers KAM's proposed approach of ongoing monitoring and adaptive management of the mine related nuisance factors as a reasonable approach to address potential adverse effects of Ajax on property values.

The EAO is also proposing EA Certificate conditions that would require KAM to make monitoring information available to the CLG and general public, serving to mitigate downward pressure on property values due to misinformation regarding the environmental effects of the project.

16.4.2 CUMULATIVE EFFECTS

In regard to cumulative effects, the EAO is of the view that contributions from past and present activities were measured by KAM in its description of baseline real estate conditions for the Kamloops market. In this manner, the effects of projects and activities that have been carried out are reflected in the existing real estate baseline conditions and have informed the identification and analysis of the residual adverse property value effects discussed above. The EAO is of the view that is unlikely that there would be cumulative adverse effects to property values resulting from reasonably foreseeable future projects overlapping with Ajax.

16.4.3 CONCLUSION

Considering the above assessment and having regard to the implementation of applicable mitigation measures proposed by KAM, the provincial conditions identified in the Table of Conditions, and the Certified Project Description (which would become legally binding in the event that an EA Certificate is issued), the EAO is of the view that Ajax is not likely to have significant adverse residual or cumulative effects on property values.

17 Aboriginal Economies

17.1 BACKGROUND

The site for Ajax is within the asserted traditional territory of SSN. SSN Aboriginal economies was included as a valued component in response to SSN's request to address the potential effects of Ajax to practices, customs, and traditions associated with their Indigenous economy.

According to KAM, Aboriginal economies are shaped by several factors associated with the social and economic environment, physical environment, and the cultural values of SSN. KAM communicated that these factors were identified based on input from SSN, consultation, and baseline reviews.

SSN communicated to the EAO that they strongly disagree with KAM's methods and conclusions. SSN defines indigenomics as economic and social development that incorporates an Indigenous perspective to better understand the importance of Indigenous groups within regional and national economies. The EAO recognizes SSN's interest in conducting an assessment of impacts to indigenomics, and understands that, for this reason, SSN included such an assessment in the SSN Assessment Process. A description of SSN's assessment process is provided in section 24.3 of this Report.

17.2 SUMMARY OF KAM'S ASSESSMENT

KAM's EIS/Application[58] assesses adverse effects to Aboriginal Economics, potential benefits, and the ability of SSN to access benefits. KAM identified the following residual adverse effects:

- A reduction in access to traditional foods for consumption resulting from the loss of traditional harvesting areas;
- Decreases in community and family cohesion from a loss of place-specific knowledge and opportunity for intergenerational transfer of traditional knowledge due to loss of traditional harvesting areas within the Ajax footprint;
- Reduced health due to reduced consumption of traditional foods associated with loss of traditional harvesting areas;
- Decreases in mental and physical health due to loss of connection with traditional territory resulting from a loss of access to some areas within the Ajax footprint;
- Increased competition for skilled labour;

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[58] In a letter dated August 7, 2015, following the issuance of the updated EISG/AIR, the EAO directed KAM to submit an assessment of the proposed Project's potential effects on SSN's Aboriginal economies by day 60 of the 180 EIS/Application review phase of the EA. This assessment was submitted in March 2016.

- Loss of place-specific knowledge and opportunity for intergenerational transfer of knowledge due to loss of traditional harvesting areas within the Ajax footprint;
- Loss of connection with traditional territory due to loss of access to some areas within the Ajax footprint; and
- Interference with other SSN land-based economic activities (negligible).

KAM also identified the following cumulative effects to SSN's Aboriginal economies:

- Reduced access to traditional foods for consumption due to loss of traditional harvesting areas;
- Loss of place-specific knowledge and opportunity for intergenerational transfer of traditional knowledge due to loss of traditional harvesting areas within the Ajax footprint; and
- Loss of connection with traditional territory due to loss of access to some areas within the Ajax footprint.

17.3 ANALYSIS AND CONCLUSIONS OF THE EAO

The EAO is of the view that these effects (including cumulative effects) are considered elsewhere in the Report and refers the reader to section 18 (Current Use of Lands and Resources for Traditional Purposes) and Part C of this Report. In consideration of this and SSN's dissatisfaction with KAM's approach and conclusions, the EAO has not concluded on the significance of effects.

Part C includes a summary of SSN's assessment of impacts to indigenomics and addresses related issues. Project benefits and the ability to access these benefits are also discussed in that section.

18 Current Use of Lands and Resources for Traditional Purposes

18.1 BACKGROUND

This section assesses the effects of changes to the environment on the current use of lands and resources for traditional purposes by aboriginal persons. The Agency defines such use as any practice or activity that is part of an Indigenous group's distinctive culture and has been routinely practiced by the Indigenous group within a timeframe established on a case by case basis, depending on the specific activity or practice.

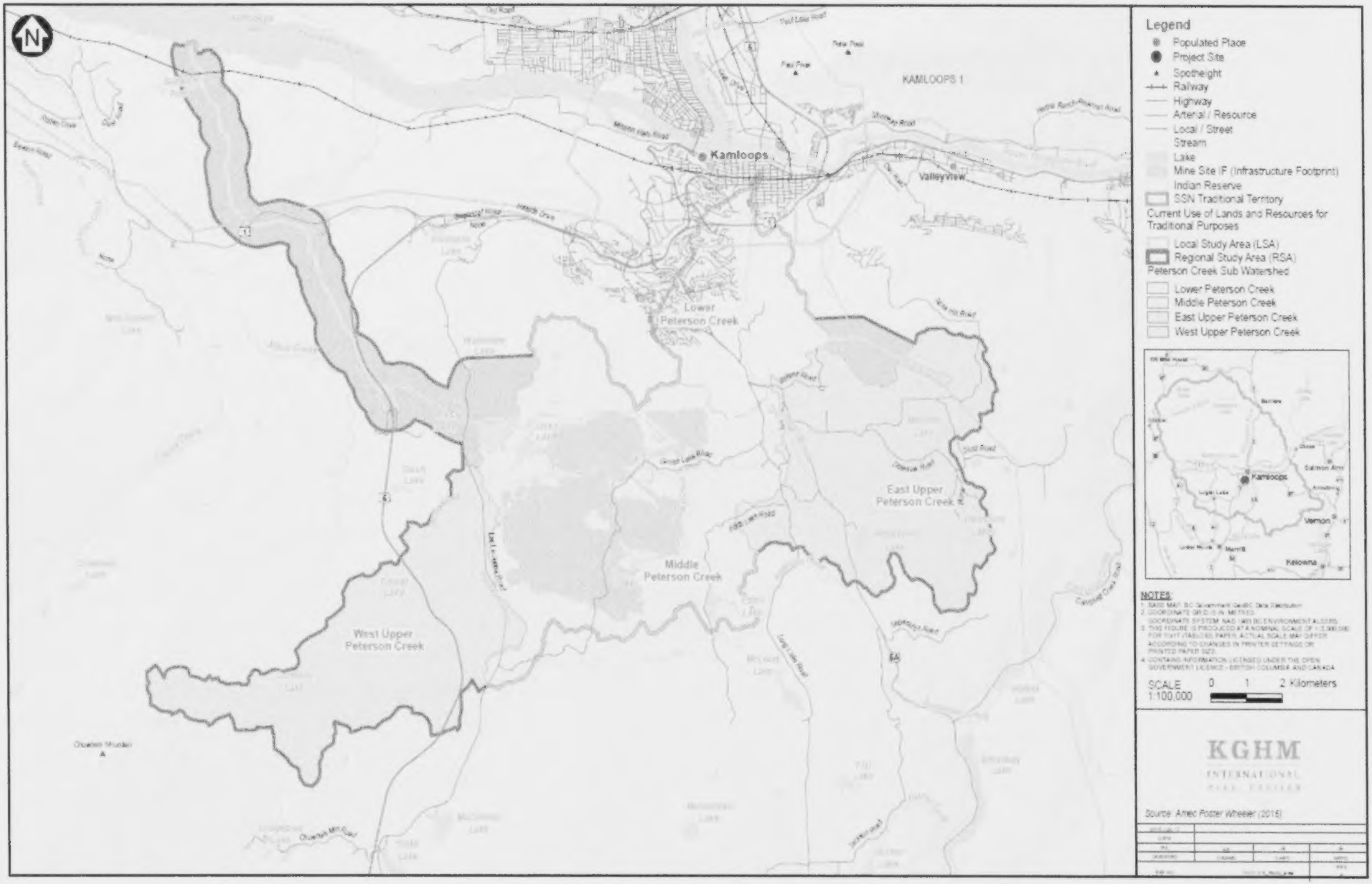
The local study area includes the middle and lower sub-catchments of Peterson Creek, which is the area within which KAM expects that Ajax effects would occur (see Figure 8). A survey of surface rights covering approximately 85% of the local study area indicates that 90% of that area is private, fee simple lands that are disturbed by current ranching and past mining activities. The remaining 10% is Crown land.

Ajax is located within the asserted traditional territory of the Secwépemc Nation, which includes Tk'emlúps te Secwépemc, Skeetchestn Indian Band, and Whispering Pines/Clinton Indian Band (Whispering Pines/Clinton). Tk'emlúps te Secwépemc and Skeetchestn Indian Band are jointly represented by Stk'emlúpsemc te Secwépemc Nation (SSN), a division of the Secwépemc Nation that reflects the traditional form of governance. Ajax also overlaps with the Nlaka'pamux Nation's asserted traditional territory, of which Lower Nicola Indian Band (Lower Nicola) and the Ashcroft Indian Band (Ashcroft) are member communities. Métis Nation British Columbia (MNBC) represents Métis citizens who harvest in the vicinity of Ajax.

The activities related to the current use of lands and resources for traditional purposes that were assessed are fishing, hunting, plant gathering, and cultural and ceremonial uses. These activities are central to the culture and/or livelihood of Indigenous groups within this region and are actively practiced in the local study area, particularly by SSN. A number of geographic areas and features in close proximity to Ajax have been identified by Indigenous groups as important for their current use of lands and resources. These include Jacko Lake, Jacko Creek, Peterson Creek, Goose Lake, the hunting blind complex, and the Thompson River.

SSN communicated that the proposed site for Ajax is in an area known as *Pípsell* (small trout), which includes Jacko Lake and the surrounding area. *Pípsell* also includes petroforms identified by SSN as part of a hunting blind complex, Goose Lake, Peterson Creek, and a prayer tree identified as *K'ecúseu* (tears welling up in someone's eyes). Further discussion related to *Pípsell*, and the importance of this area to SSN, is found in Part C of this Report.

Figure 8: Local and Regional Study Area for Current Use of Lands and Resources for Traditional Purposes Defined by KAM


N
Kamloops
KAMLOOPS 1
Valleyview
Lower Peterson Creek
Middle Peterson Creek
East Upper Peterson Creek
West Upper Peterson Creek
Legend
Populated Place
Project Site
Spotheight
Railway
Highway
Arterial / Resource
Local / Street
Stream
Lake
Mine Site IF (Infrastructure Footprint)
Indian Reserve
SSN Traditional Territory
Current Use of Lands and Resources for Traditional Purposes
Local Study Area (LSA)
Regional Study Area (RSA)
Peterson Creek Sub Watershed
Lower Peterson Creek
Middle Peterson Creek
East Upper Peterson Creek
West Upper Peterson Creek
Kamloops
Salmon Arm
Vernon
Kelowna
Merritt
NOTES:
SCALE
1:100,000
0
1
2 Kilometers
KGHM
INTERNATIONAL
Source: Amec Foster Wheeler (2016)

Source: EIS/Application – Figure 8.5-6

18.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

KAM's consultation with Indigenous groups to gather information relating to potential effects to current use of lands and resources for traditional purposes included hosting community meetings, meetings with Indigenous leadership, and providing Indigenous groups with capacity funding to participate in the EA process. In addition, KAM provided SSN with funding to complete a Cultural Heritage Study and to develop a Preliminary Mitigation Report, which were then used to inform KAM's assessment. Although Ashcroft, Lower Nicola, and Whispering Pines/Clinton expressed general concerns about the effects of Ajax on harvesting and other traditional land uses, KAM received limited information relating to specific fishing, hunting, trapping, and plant gathering locations, or other cultural uses, for these groups.

For each current use activity, KAM considered how Ajax would affect the availability of, access to, and quality of the resource, as well as the experience of practicing the traditional use.

18.2.1 EFFECTS TO FISHING

Current fishing practices by Indigenous groups in the vicinity of Ajax include SSN's spring trout fishery at the outlet of Jacko Lake, which provides SSN with one of their first sources of fish after the winter. MNBC also identified Jacko Lake as a fishing area for its members. The Thompson River has been identified by Whispering Pines/Clinton, Ashcroft, and SSN as an important area for salmon and trout fishing; however, KAM predicted that reduced flows and changes to water quality resulting from Ajax would be negligible in the Thompson River, and therefore that effects to fishing in the Thompson River are not anticipated.

18.2.1.1 *Availability*

KAM noted that construction and operation of Ajax would result in a permanent loss of fish habitat within the northeast arm of Jacko Lake (2.08 hectares lake habitat), which represents approximately 4% of the total lake area. This portion of the lake, identified as a highly productive area for fishing, would no longer be available to SSN for fishing. However, given that the Rainbow trout population in Jacko Lake is currently managed through stocking, KAM expects that availability of Rainbow trout for the SSN fishery in Jacko Lake would not be affected.

KAM expects that, prior to the implementation of mitigation measures, fish habitat losses would reduce the availability of Rainbow trout within Peterson Creek downstream of Ajax due to flow reductions. A total of 10.38 hectares of fish habitat would be lost from Jacko Lake and Peterson Creek, including 3.35 hectares of stream habitat, 1.87 hectares of lake habitat, and 5.16 hectares of riparian habitat. Fish mortality may increase due to the vibrations caused by blasting in the open pit and the installation of the sheet pile dam required for the development of the open pit. Increased fishing pressure in the local study area due to increased access by recreational fishers associated with Ajax, such as employees and contractors, may result in a reduction in trout availability.

18.2.1.2 *Access*

During construction and operation, KAM would enforce safety zones around the open pit during blasting periods, resulting in temporarily restricted access to SSN's spring trout fishery on Jacko Lake. Blasting is expected to be undertaken once per day, creating a window of approximately two hours during which SSN members would be unable to engage in fishing activities. KAM expected the safety zone would extend across the eastern half of the lake for approximately the first ten years of operations, which would affect access to SSN's spring trout fishery. Roads within the Ajax tenure area would be closed except to authorized Ajax vehicles and other approved vehicles during all phases of Ajax. KAM stated that the proposed changes to the public access road and boat launch on Jacko Lake would improve access to public roads.

18.2.1.3 *Quality*

The human health and ecological risk assessment (see section 10 on Human Health) considered predicted changes in water quality resulting from Ajax, which were used to estimate the implications for the consumption of fish. KAM predicted that Ajax would not result in an increased health risk due to consumption of fish that have taken up project related metals. KAM has committed to monitoring metal levels in fish, and updating the human health and ecological risk assessment (see section 10) and mitigation measures if appropriate.

18.2.1.4 *Experience*

KAM indicated that Ajax-related noise disturbances would be noticeable in the Jacko Lake area and may diminish the experience of fishing. The highest noise levels are expected at Jacko Lake during sheet piling activities (over 75 dBA), and would occur during the day at the eastern part of the lake for approximately two months during the construction phase. During all phases of Ajax, dust generation may result in a decrease in air quality which could also affect the experience of fishing. The main Ajax components, such as the mine rock storage facilities and the tailings storage facility, would be noticeable from locations such as Jacko Lake and lower Peterson Creek, which could diminish the visual experience.

18.2.1.5 *Mitigation Measures*

Measures proposed by KAM to reduce potential effects to fishing include compensation to address habitat loss through fish habitat offsetting. KAM redesigned the Peterson Creek Diversion System to retain the spillway at the outlet of Jacko Lake, on which SSN's spring trout fishery depends. This design aims to maintain current flow conditions and allow fish passage as much as practicable. To mitigate potential effects of increased fishing pressure associated with the introduction of workers, KAM would implement a policy that prohibits employees from fishing during shifts. Blast designs and procedures would be in accordance with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat to limit direct mortality of fish, sub-lethal effects or changes in behavior due to noise and vibration. See
section 4 on Fish and Fish Habitat for a detailed assessment and description of mitigation measures.

Changes to access because of blasting would be mitigated through signage to inform fishers at Jacko Lake about appropriate times to access the area for fishing. To enable SSN's access to their spring trout fishery, KAM would avoid carrying out construction activities within Jacko Lake during spring. Additionally, blasting would not occur during the spring trout fishery from sunrise to 10:00 am if SSN members are fishing. KAM would aim to improve access to Jacko Lake via a new road, boat launch, day-use area, and shoreline trails for fishers.

To minimize dust and contaminants entering water bodies during construction, operation, and decommissioning and closure phases and decreasing the quality of fish tissue, coarse gravel and aggregate material would be used on road beds, haul distances would be minimized, and haul roads would be watered. Covers would be installed over coarse and fine ore stockpiles.

KAM would mitigate noise effects which could contribute to a decreased fishing experience by using multi-passenger vehicles to transport crews to reduce overall traffic and limiting the use of vehicle horns.

18.2.2 EFFECTS TO HUNTING

KAM identified that SSN members currently hunt deer, moose, elk, grouse, badger, cougar, marmot, and lynx in the vicinity of Ajax. KAM reports that limited information about specific hunting locations within the local study area was provided by Ashcroft, Lower Nicola, MNBC, or Whispering Pines/Clinton. Métis citizens raised concerns about effects to badgers in the local study area.

Wildlife is harvested for food, trade, ceremonial, medicinal, and technological purposes (e.g. antlers used to tan hides and skins used for clothing). While popular hunting areas in the vicinity of Ajax also include the Sugarloaf Ranch, Cherry Creek, Chuwels Lake, Inks Lake, Lac Le Jeune, and Greenstone Mountain, KAM focussed on potential effects on current hunting activities in or near the Ajax footprint, such as areas surrounding Jacko Lake, Peterson Creek and Goose Lake, where residual environmental effects, including wildlife habitat loss, noise disturbances, and changes to access of hunting areas, may occur.

18.2.2.1 *Availability*

During construction and operation, terrestrial habitat of value to harvested wildlife species could be lost due to land clearing. For example, KAM estimated that approximately 1,163 hectares of suitable badger habitat, 1,085 hectares of suitable grouse habitat, and 33 hectares of critical deer winter range would be lost from the local study area. This loss of habitat has the potential to result in reduced numbers of wildlife available for hunting. Noise disturbances could deter wildlife from using valuable terrestrial habitats. There is also an increased risk of wildlife mortality due to increased traffic during construction. KAM expects that Ajax could increase competition for hunted resources from the presence of KAM employees and contractors.

18.2.2.2 *Access*

During construction and operation, hunting areas within the mine site may not be accessible or access may be restricted. Safety zones enforced around the open pit during blasting periods would include restricted access to potential hunting areas (e.g. south shores of Jacko Lake). Existing roads within the mine site would be closed (i.e. Goose Lake Road), which may affect access to hunting locations outside of the mine site. Access to the portion of Peterson Creek within the footprint of the mine would be inaccessible for hunting until the post closure phase, when KAM may provide Indigenous hunters access to areas within the Ajax footprint where safety is not an issue. Additionally, KAM noted increased traffic generated by Ajax may increase the amount of time required to access hunting sites.

18.2.2.3 *Quality*

Ajax would generate dust and would change the hydrological regime in the local study area, however, KAM does not expect that Ajax-related activities would result in harmful accumulation and release of metals from downstream surface water. The ecological risk assessment results, as part of the human health and ecological risk assessment, which specifically evaluated species that are harvested for consumption, did not identify elevated risks (see section 10 on Human Health). KAM therefore predicted that Ajax would not be likely to impact the quality of wildlife harvested for consumption.

18.2.2.4 *Experience*

Similar to the fishing experience, KAM predicted the hunting experience may be impacted by noise and visual disturbances and reduced air quality, particularly in the Jacko Lake area, while other sites within the local study area may not be affected.

18.2.2.5 *Mitigation Measures*

Mitigation measures proposed by KAM to reduce potential effects to the availability of hunting opportunities and practices include designing the Ajax footprint to be as small as possible to ensure the minimum possible effect on habitat. In part because of concerns raised with respect to hunting at Inks Lake, which is an area widely used by waterfowl and other wildlife, the fish habitat offsetting has been relocated to avoid Inks Lake.

With respect to deer, KAM would avoid habitat loss and vegetation clearing during rutting (i.e., breeding) season (September and October), to reduce the effects of habitat removal on reproducing individuals. KAM would also avoid, when possible, sensitive wildlife areas, including deer wintering habitat and sharp-tailed grouse leks. With respect to badgers, KAM would fence known badger habitat and enhance lands that could represent suitable badger habitat to provide better forage opportunities. See section 6 on wildlife for a detailed assessment and description of mitigation measures.

KAM committed to additional mitigation measures to further reduce effects on grasslands, including implementation of a program for grassland restoration to address the time lag of temporal losses of grasslands prior to reclamation (see section 5 on Vegetation). KAM would enforce speed limits and would utilize wildlife signage to help reduce direct mortality to wildlife. KAM would implement a no-hunting policy to prohibit employees and contractors from hunting while on shift, and would not permit hunting or fishing in the Ajax tenure area at any time. There would be no permitted access to fishing or hunting areas from within the mine site.

KAM would post signage to indicate blasting times and restricted areas to inform hunters at Jacko Lake of available times to access hunting areas.

To minimize dust and contaminants entering water bodies during construction, operation, and decommissioning and closure phases and decreasing the quality of wildlife tissue, coarse gravel and aggregate material would be used on road beds, haul distances would be minimized, and haul roads would be watered. Covers would be installed over coarse and fine ore stockpiles.

KAM would mitigate noise impacts which could contribute to a decreased hunting experience by using multi-passenger vehicles to transport crews to reduce overall traffic and limiting the use of vehicle horns.

18.2.3 EFFECTS TO PLANT GATHERING

KAM reported that SSN considers the mine site and surrounding areas to be desirable harvesting areas for a variety of plant foods and medicines. The area surrounding Ajax provides opportunities for early spring plant gathering because of its low elevation and because it is usually snow free by February or March. Plant species harvested are used for medicinal, food, technological, spiritual, and ceremonial purposes. A number of grassland plant species used by Indigenous groups are considered endangered or threatened as a result of impacts of development, such as city infrastructure, mining, pipelines, and ranching. The area around Jacko Lake was historically seen as a preferred harvesting area by SSN for a number of traditional medicinal plants, which may be due in part to the unique mineral content of the soil. Métis citizens also identified Goose Lake as a plant gathering area.

18.2.3.1 *Availability*

KAM highlighted an ethnobotanical inventory conducted by SSN's research team that indicated there are 127 culturally important plant species present in the local study area, including berries, root plants, and medicinal plants. Of the 184 occurrences of traditional use plants within the local study area, 104 (56%) would be lost due to clearing within the Ajax footprint. KAM does not anticipate any losses of plant habitat in the upper and lower portions of the Peterson Creek catchment. Species of traditional use plants that would be lost include Douglas fir, yarrow, big sagebrush, lemonweed, and saskatoons. Additionally, 1,085 hectares (35%) of grassland habitat in the local study area would be lost to the mine site during construction and operation. Reestablishment of grasslands during post-closure could take up to 25 years depending on soil conditions, seed mixes, and project activities.

18.2.3.2 *Access*

Given the nature of Ajax activities and likely disturbances generated during construction and operation, KAM assumed that SSN would no longer be able to gather in the Ajax footprint until post closure. Access to Peterson Creek, within the footprint of the mine, would also continue to be inaccessible for plant gathering. Goose Lake would be removed and would no longer be available for plant gathering activities, although KAM states that plant gathering in this area is currently limited due to private property and fencing.

18.2.3.3 *Quality*

KAM anticipated that Ajax would generate dust fall in the local study area which could affect the quality of plants and result in degradation of some plant habitat. The risk to human health associated with the ingestion of country foods, including plants, has been assessed under the health valued component (see section 10 on Human Health).

18.2.3.4 *Experience*

Ajax-related noise disturbances, along with air quality deterioration and visual disturbances, would result in changes to the experience of plant gathering, particularly in the Jacko Lake area. Other areas in the local study area may not be as affected by these disturbances.

18.2.3.5 *Mitigation Measures*

The Closure and Reclamation Plan would prioritize the rapid re-vegetation of all temporarily disturbed areas and would use seed mixes that minimize the spread of invasive plants. KAM anticipates that this would be moderately effective, as the establishment of invasive species can be managed but not completely avoided. Grassland reclamation would primarily target the tailings storage facility surface.

Mitigation measures to control air and dust emissions, which could impact the quality of plants used for human consumption, outlined in the air quality effects assessment (see section 8 of this Report), would reduce Ajax emissions to levels that KAM predicts would be protective of human health.

18.2.4 EFFECTS TO CULTURAL AND CEREMONIAL USES

KAM reports that SSN has identified *Pipsell* as an area of cultural and ceremonial significance that includes Jacko Lake and the surrounding areas, Goose Lake, Peterson Creek, areas associated with the hunting blind complex, and a prayer tree identified as *K'ecúseu*. Jacko Lake is used by SSN members to perform *Etsxem*, or ritual fasting and vision quests. Sweat lodges for men and women, recently constructed by SSN, are located near the inflow and outflow creeks to Jacko Lake, respectively. The sweats at *Pípsell* have been noted for their unique restorative nature by SSN knowledge keepers. Culturally modified trees are also present in the Jacko Lake area, which SSN notes support stories outlining the special significance of the area to SSN people.

SSN's Trout Children *Stseptékwll* is an oral history that explains the relations between humans and the trout people who are said to live in and under Jacko Lake. The Trout Children *Stseptékwll* embodies a worldview, provides guidance, and is at the heart of ceremony and spiritual connectedness that are fundamental to the continuance of SSN culture. Additional detail on the Trout Children *Stseptékwll* and effects of Ajax are found in Part C of this Report.

KAM reports that SSN has stated that Ajax could affect the inter-generational teaching of languages or the teaching of traditional practices such as fishing, hunting, plant gathering, or other ceremonial practices.

18.2.4.1 *Availability*

The mine site would occupy components of *Pípsell* including the hunting blind complex, Goose Lake, and middle Peterson Creek, resulting in a permanent loss of these areas for ceremonial use. The hunting blind complex would need to be permanently removed as it is located in the area proposed for the open pit. Impacts to this site are further discussed in section 19 on Heritage. During operation, use of the northeast arm of Jacko Lake would no longer be available to SSN for ceremonial use.

18.2.4.2 *Access*

Through all phases of Ajax, roads within the mine site (e.g. Goose Lake Road) will be closed, affecting access. The Jacko Lake prayer tree is located in the vicinity of Jacko Lake and falls within the blasting safety zone. While the Jacko Lake prayer tree would not be directly impacted by Ajax activities, it would not be accessible for ceremonial purposes during blasting periods.

18.2.4.3 *Experience*

Ajax-related noise disturbances, along with air quality deterioration and visual quality disturbances, would result in changes to the experience of using areas for ceremonial and cultural practices. It is anticipated that main components of Ajax, such as the mine rock storage facilities and the tailings storage facility, would be noticeable from Jacko Lake and Peterson Creek. The highest noise levels are expected at Jacko Lake during sheet piling activities (over 75 dBA), and would occur during the day at the eastern part of the lake for approximately two months during the construction phase. Lower levels of noise would continue to be noticeable for the remainder of the construction phase.

18.2.4.4 *Mitigation Measures*

KAM would develop an Access Management Plan, in consultation with Indigenous groups, which would accommodate safe access to the area when required for ceremonial and cultural uses. KAM would also support

SSN to participate in accessing areas and/or documenting resources of cultural value prior to the Ajax footprint disturbance. As part of its social responsibility policy, KAM would inform all employees of their duty to respect Indigenous culture and practices. KAM would also make reasonable efforts to accommodate working schedules for Indigenous employees that engage in activities for traditional purposes.

18.2.5 KAM'S CONCLUSIONS ON RESIDUAL EFFECTS

KAM concluded that, after implementation of mitigation measures, Ajax would result in residual effects to the current use of lands and resources for traditional purposes by aboriginal persons.

18.2.5.1 *Cumulative Environmental Effects*

KAM determined that the cumulative effects on current use of lands and resources for traditional purposes are significant for hunting, plant gathering, and ceremonial uses, and not significant (moderate) for fishing. KAM's view is that cumulative effects for hunting, plant gathering, and ceremonial uses are significant as the cumulative effects before Ajax are already significant because of extensive development in the area, particularly due to agricultural activities. KAM notes that Ajax represents a minor contribution to the cumulative effects that are already present in the regional study area. KAM expects that the overall levels of land disturbance would be partially mitigated once Ajax reaches its decommissioning and closure phase and re-vegetation is implemented to achieve post-closure land use objectives. However, after implementation of mitigation, KAM expects that the level of disturbance in the terrestrial habitat would remain at above 80 percent levels in both the local study area and regional study area.

18.2.5.2 *Monitoring and Follow Up*

In addition to the mitigation measures proposed for effects to the current use of lands and resources for traditional purposes, KAM proposed to establish a committee with SSN to facilitate implementation of mitigation and monitoring plans for biophysical components. Biophysical effects monitoring would contribute to determining whether or not there is a change in the opportunity to conduct ceremonial activities

KAM also plans to monitor vegetation during the post-closure phase to ensure that the vegetation is taking hold and growing in a manner sufficient to mimic the natural landscape. KAM anticipates that Indigenous groups would be engaged in these monitoring activities.

18.3 DISCUSSION OF ISSUES

The Agency and EAO did not receive comments from the public or other working group members specific to the effects of Ajax on the current use of lands and resources for traditional purposes by aboriginal persons. SSN identified a number of outstanding concerns related to their current use of lands and resources for traditional purposes.

With regards to fishing, SSN expressed that the spring trout fishery at Jacko Lake is an important activity for intergenerational transfer of knowledge, culture, and ceremonial purposes. Additionally, SSN noted that the spring trout fishery at Jacko Lake is an ideal inland fishery for SSN families who are currently facing decreased availability of sockeye and other salmon in the Thompson River system. KAM indicated that, through its proposed Fish Habitat and Fishery Offsetting plan, SSN's spring trout fishery at Jacko Lake will continue to be available. SSN stated that self-imposed closures and perception of risk by their members may have a greater impact than biophysical effects, and that these impacts were not adequately described by KAM. KAM indicated that they would seek to address the possibility of self-imposed closures by engaging SSN in a meaningful way in mitigation and monitoring planning, and through the establishment of a Joint Mine Committee with SSN.

SSN stated that their traditional knowledge identifies a conduit which would result in the complete loss of Jacko Lake as it empties into the open pit. KAM conducted a hydrotechnical study of the connectivity between Jacko Lake and the open pit which identified barrier boundary hydrogeological conditions. Therefore, KAM concluded that the connectivity is very limited and would not result in Jacko Lake emptying into the open pit.

With regards to hunting, SSN believes that the excavation of the open pit would disrupt the migratory path used by animals such as moose and mule deer, and that KAM has not adequately addressed this potential effect. KAM stated that it assessed the potential effects to moose and mule deer in the EIS/Application and have proposed mitigation measures for each potential effect.

SSN is also concerned with cumulative effects of land disturbance in their asserted territory on moose, mule deer, and sharp-tailed grouse populations. Game bird hunting is frequently used to train adolescent hunters and there is concern that habitat of the Columbian sharp-tailed grouse in the Kamloops area is declining and would be further impacted by Ajax. To mitigate effects to grouse habitat, KAM proposed grassland enhancement and restoration and committed to replacing lost grouse leks at a ratio of 2:1.

SSN views *Pípsell* as a cultural keystone area, described as a locale that is exceptionally well known, and critical to a community's identity and well-being. SSN maintains that Ajax would forever alter the landscape which manifests the spiritual connection and resource use of their members. SSN members go to *Pípsell* to connect with their ancestors and *stseptékwll* (oral histories) and would be unable to do so if they are subject to noise, light, and other pollutants during the operation of the mine. SSN members would also avoid the local study area due to strong perceptions of risk and the stress associated with the disruptions to their ancestors and relations (wildlife, plants, water, and sky). SSN stated that the 20-25 year interruption in the ability of community elders to pass on knowledge and cultural practices to the youth will irreparably disrupt the intergenerational knowledge transfer opportunities unique to *Pípsell*. KAM indicated that it would take actions to help sustain traditional harvesting and intergenerational transfer of knowledge through such measures as provisions for safe access for SSN members to Jacko Lake during the life cycle of Ajax, supporting SSN in documenting past, present, and future land uses in the areas surrounding Ajax, and making reasonable efforts to accommodate working schedules for Indigenous employees that engage in activities for traditional purposes.

SSN disagrees with the manner in which the effects of Ajax on their current use of lands and resources for traditional purposes have been assessed by KAM. SSN views all aspects of *Pípsell* as being interconnected and that KAM's assessment serves to fragment impacts into components which are related to pathways. SSN stated that these components or pathways were never agreed upon, and that the application of western value component methodology and current use assessment does not adequately convey the impact as it relates to SSN's interests. KAM stated that its assessment was done in accordance with provincial and federal laws and regulations and in compliance with the EISG/AIR, upon which SSN was consulted. KAM also stated that it engaged SSN on this topic during the development of the assessment and during EIS/Application review.

SSN conducted their own assessment process (further described in Part C of this Report) and determined that Ajax is fundamentally in opposition to SSN's land use objectives for *Pípsell*. Some post-closure land use objectives were proposed by SSN as part of their assessment process; KAM agreed to adopt these and to continue dialogue with SSN in the future as the Mine Closure and Reclamation Plan is developed and implemented. KAM also proposes to create a Joint Mine Committee to engage SSN in the mitigation and monitoring activities required for Ajax.

18.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

18.4.1 CURRENT USE OF LANDS AND RESOURCES FOR TRADITIONAL PURPOSES

The Agency and EAO drew upon information provided by KAM and Indigenous groups when assessing the potential effects of Ajax on the current use of lands and resources for traditional purposes by aboriginal persons. The assessments conducted for fish and fish habitat, wildlife, vegetation, surface water, human health, recreation, heritage, and air quality were also used to inform this assessment. The SSN Assessment Process provided substantial information about SSN's views on the cultural significance of *Pípsell* and the effects of Ajax on the ability of SSN members to practice traditional activities in the area.

The Agency and EAO consider that SSN's spring trout fishery would continue to be available, as the effects of Ajax on the availability of trout and access to the site would be adequately mitigated. However, it is unknown if Indigenous users would choose to practice this activity due to the decrease in the quality of the fishing experience and perceived risks to fish quality. Due to the close proximity to the open pit and the subsequent noise and visual disturbances, the experience of harvesting fish at the outlet of Jacko Lake would be diminished. The trout fishery at Jacko Lake is a central aspect of *Pípsell*, and the presence of Ajax would compromise the integrity of this cultural keystone area, rendering the effects irreversible. SSN members may also avoid the fishery due to the perception of contamination and stress to the fish population. The Agency and EAO consider the residual effects on fishing as a current use of land and resources for traditional purposes to be high magnitude, far-future, continuous, regional in extent, and irreversible. There is a moderate likelihood of the residual effect occurring, as there is some uncertainty whether SSN members would avoid the fishery due to the perception of contamination and stress to the fish population.

The loss of land associated with the mine site would have an adverse effect on suitable habitat for certain terrestrial wildlife species harvested by Indigenous users, including sharp-tailed grouse, badger, and deer. The mine site would also result in the loss of some traditional plant species that are harvested by Indigenous persons. The Agency and EAO consider that, while the experience of hunting and plant gathering in proximity to the mine site would be diminished and there could be less availability of harvested species, Indigenous users would still have access to hunt and gather traditional plants in other areas that are a further distance from the mine site. The Agency and EAO recognize that there is a level of uncertainty regarding the timing and extent that the grasslands affected by Ajax would be successfully reclaimed to pre-Ajax levels.

The Agency and EAO concur with KAM that consumption of country foods (fish, wildlife, and plants) is unlikely to lead to increased health risks due to Ajax. The Agency and EAO consider the residual effects on hunting and plant gathering as current uses of lands and resources to be medium in magnitude, long-term, continuous, and regional in extent, the effect would be irreversible due to the loss of opportunities for inter-generational knowledge transfer. There is a medium likelihood of the residual effect occurring, as there is some uncertainty as to the timing and extent that grasslands affected by Ajax would be successfully reclaimed.

The spiritual and cultural significance of *Pípsell*, as articulated by SSN, is unique in that the ceremonial activities and practices are associated with the area itself. While some sites may continue to be accessible, the integrity of the visual landscape and sensory environment is an important factor in considering the suitability of the area for continued use. Residual noise and dust effects, as well as reduced visual quality, would limit the ability of Indigenous users to practice traditional activities in a peaceful and enjoyable manner. The Agency and EAO acknowledge that it would not be reasonable to expect Indigenous groups who are currently practicing ceremonial activities in areas that would be affected by Ajax to use alternate areas, either temporarily or permanently, due to the unique significance of the area for spiritual and cultural reasons. Additionally, a large portion of the surrounding area is currently used for agricultural or other land purposes and may be inaccessible or unsuitable for traditional activities. With respect to SSN, the Agency and EAO conclude that residual effects on cultural and ceremonial activities as a current use of lands and resources for traditional purposes to be of high magnitude, given the cultural and spiritual significance of *Pípsell*. The Agency and EAO consider the effects to be at a regional scale, far-future, continuous, and irreversible. There is a high likelihood of the effect occurring, as the mine site overlaps with *Pípsell.*

The EAO has proposed an EA Certificate condition that would require KAM to develop a SSN Access Management Plan in consultation with SSN. The plan would be required to set out an approach to provide opportunities for SSN to engage in traditional land use practices on the site, as safety permits. The EAO has also proposed requirements in many EA Certificate conditions for KAM to consult with SSN on the development of management plans. The EAO has also proposed requirements in EA Certificate conditions that KAM describe how traditional use information provided by SSN will be incorporated into the Wildlife Management and Monitoring Plan, the Grassland Restoration and Enhancement Program, the Wetland Offsetting Plan, and the Reclamation Management Plan.

18.4.2 CUMULATIVE EFFECTS

In assessing cumulative effects on the current use of lands and resources for traditional purposes, the Agency and EAO concur with KAM's statement that extensive development in the Ajax area, particularly due to agricultural activities, has resulted in a high level of land disturbance. These past and existing land uses have resulted in a reduction of suitable areas for Indigenous groups to carry out fishing, hunting, plant gathering, and cultural or ceremonial activities. SSN's view of the spiritual and cultural significance of *Pípsell* means that members would not able to carry out current use activities in the same way elsewhere within their asserted traditional territory, and any additional effects of Ajax would exacerbate the considerable effects on current use that are currently being experienced at a regional scale.

The Agency and EAO's characterization of the residual effects of Ajax on current use of lands and resources for traditional purposes, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

18.4.3 CONCLUSION

Considering the above assessment, and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is likely to cause significant adverse environmental effects to the current use of land and resources for traditional purposes by aboriginal persons due to effects to fishing and cultural and ceremonial uses of *Pípsell*.

The Agency and EAO conclude that the cumulative effects of Ajax on the current use of lands and resources for traditional purposes by aboriginal persons are likely to be significant due to cumulative effects to fishing and cultural and ceremonial uses of *Pípsell*.

19 Heritage

19.1 BACKGROUND

This section provides a summary of the assessment of potential effects of changes to the environment on physical and cultural heritage, which includes effects to archaeological sites, Indigenous heritage, and early settlement heritage sites and paleontological resources.

Pípsell and the hunting blind complex are important aspects of Indigenous heritage that are discussed throughout this section. *Pípsell* is the name for the cultural keystone area that includes Jacko Lake and the surrounding area. SSN has identified the hunting blind complex as one important aspect of *Pípsell.* A hunting blind is commonly known as a cover or structure for hunters to hide while hunting, and SSN has identified current and past uses of the complex.

19.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

19.2.1 DESCRIPTION OF BASELINE ENVIRONMENT

19.2.1.1 *Archaeological Sites*

Archaeological sites are physical sites of past human activity and are protected under the British Columbia *Heritage Conservation Act* and *Local Government Act*. There are 46 archaeological sites within the local study area, including 28 that are within 50 m of the Project footprint. KAM identified the former location of the St. Peter's Anglican Church and associated cemetery, which was constructed in 1915 and dismantled in the late 1920s, as a heritage site of particular archaeological importance within 50 m of Ajax footprint. In addition, KAM identified a lithic scatter[59] with projectile point, a modified ungulate tooth, and a series of petroforms comprising part of the hunting blind complex as archaeological sites of importance. KAM has identified that, although they have completed extensive archaeological surveys, there is the potential for new archaeological sites to be discovered during ground disturbing activities.

19.2.1.2 *Early Settlement Heritage Sites and Paleontological Resources*

European exploration of the Kamloops area started in the early 1800s, and European settlement began in the 1840s and 1850s when gold was discovered in the area. There are 15 historic heritage sites related to homesteading and settlement within the local study area, in addition to two hearth-campfire features. All of these homesteads, except one, have structures which are still standing.

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[59] A lithic scatter is a scatter of stone artifacts

KAM has not identified any fossils or paleontological resources within the local study area. KAM reported that the local study area has low fossil potential based on the rock type present, with the exception of one area of the transmission line corridor.

19.2.1.3 *Indigenous Heritage*

KAM identified a series of petroforms comprising part of the hunting blind complex and four lithic scatters surrounding Jacko Lake as Indigenous heritage sites associated with *Pípsell* and the Trout Children Story. These Indigenous heritage sites are also considered as archaeological sites and described in the section above. KAM reported that SSN advised that the hunting blind complex encompasses a wider area than the petroforms, and that the hunting blind complex is a place of transmission of culture, including ceremonies and prayer.

There are many rock piles located throughout the Ajax area. Additionally, there are rock piles of particular importance to SSN north of the local study area that SSN has noted may have been used to mark and protect burials. KAM's archaeological assessment concluded that the 64 rock piles located within 50 m of the Ajax footprint are likely related to historic ranching and farming activities.

19.2.2 POTENTIAL EFFECTS AND MITIGATION MEASURES

19.2.2.1 *Archaeological Sites*

KAM concluded that the 28 archaeological sites within 50 m of the Ajax footprint would be directly affected by construction activities. These sites are mostly prehistoric lithic scatters or lithic finds of low importance, with the exception of the St. Peter's Anglican Church and cemetery, projectile point, and the modified ungulate tooth, which are of moderate archaeological importance. KAM contacted the Anglican Church and was advised that the next-of-kin for the one individual known to be buried on site has expressed an interest in having the burial moved. KAM stated that the final selection of mitigation measures for St. Peter's Anglican Church would be determined in consultation with the Archaeology Branch and the Anglican Church. KAM indicated that the Anglican Church may also consult with the next-of-kin as part of selection of final mitigation measures. Mitigation measures for all other archaeological sites would be developed in consultation with the Archaeology Branch and would likely include detailed mapping, photography, systematic data recovery, or site capping (surface collection or controlled excavation or filling, and covering the site in a way that preserves and protects the site from activities).

The other 18 archaeological sites within the local study area but further from the Ajax footprint could be affected directly through environmental changes associated with increased human presence in the area, which would occur during all phases of Ajax. For sites within 150 m of construction activities, KAM would flag and/or fence the sites as no work zones.

Ajax would have the potential to affect archaeological sites which have not yet been recorded. In the event suspected archaeological resources are found, KAM has committed to the following Chance Find Procedure: workers would stop all work, leave the material in place, and report the find to their supervisor who would report the find to KAM's archaeologist. Should the archaeologist confirm that the suspected find is an archaeological site, KAM would attempt to avoid the site. If site avoidance is not possible, KAM would consult with the Archaeology Branch and Indigenous groups (if applicable) to identify appropriate mitigation measures. Mitigation measures may include detailed mapping, photography, systematic data recovery, or site capping.

19.2.2.2 *Early Settlement Heritage Sites and Paleontological Resources*

KAM identified that Ajax has the potential to directly or indirectly affect 15 sites related to homesteading and settlement within the local study area. KAM would consult with community stakeholders for all sites likely to be directly affected and determine appropriate mitigation measures in consultation with the Heritage Branch.

KAM identified the potential for Ajax to affect potential paleontological resources in the transmission line corridor which have not yet been recorded. KAM would apply the Chance Find Procedure, as described above, in the event that a worker uncovers suspected paleontological resources.

19.2.2.3 *Indigenous Heritage Sites*

KAM focused its assessment on tangible aspects of Indigenous heritage sites, which includes archaeological sites.

KAM concluded that the four lithic scatters along the shores of Jacko Lake area that are associated with the Trout Children Story could be directly affected through construction activities. KAM would work with the Archaeology Branch and SSN to determine the final selection of mitigation measures. Mitigation measures would likely include consideration of Project re-design to avoid the sites, detailed mapping, photography, systematic data recovery, or site capping.

KAM notes that the hunting blind complex is located within the proposed location of the open pit, and avoidance of the site would not be possible. KAM would determine the final selection of mitigation measures through further consultation with SSN and the Archaeology Branch, and has proposed mitigation measures that include relocating features of the site to a location identified by SSN, documenting the site using 3D imagery, preparation of a documentary or scaled 3D model for educational purposes, and funding for heritage education programming. KAM acknowledged SSN's view that removal and reconstruction of the complex is not an acceptable mitigation measure.

19.3 KAM'S CONCLUSIONS ON RESIDUAL EFFECTS

19.3.1 *ARCHAEOLOGICAL SITES*

KAM concluded that, after implementation of mitigation measures, Ajax would result in the following residual environmental effects to archaeological sites:

- Disturbance to known archaeological sites, including the hunting blind complex; and
- Potential disturbance to unknown archaeological sites.

19.3.2 *EARLY SETTLEMENT HERITAGE SITES AND PALEONTOLOGICAL RESOURCES*

KAM concluded that, after implementation of mitigation measures, Ajax would not result in residual effects to early settlement heritage sites and paleontological resources.

19.3.3 *INDIGENOUS HERITAGE*

KAM concluded that, after implementation of mitigation measures, Ajax would not result in residual effects to Indigenous heritage.

19.3.4 CUMULATIVE EFFECTS

KAM assessed the potential for residual effects from Ajax on archaeological sites to interact with residual effects from other projects and activities, but did not identify any interactions due to the site-specific nature of archaeological sites and the requirement of other projects and activities to also mitigate potential effects to archaeological sites.

19.4 MONITORING AND FOLLOW-UP

KAM developed an Archaeological Sites Management Plan to support community and Indigenous engagement in the selection and implementation of mitigation measures. This plan confirmed KAM's mitigation hierarchy and commitment to implement mitigation measures as described above. The mitigation hierarchy states that KAM would first attempt to avoid the site. If site avoidance is not possible, KAM would consult with the Archaeology Branch and Indigenous groups (if applicable) to identify appropriate mitigation measures. Mitigation measures may include detailed mapping, photography, systematic data recovery, or site capping. The plan also outlined KAM's commitment to visually examine archaeological sites in close proximity to construction activities during and after construction. In addition, KAM would visually examine archaeological sites between 150 m and 500 m of construction activities on an annual basis. Consistent with the *Heritage Conservation Act,* should effects to these archaeological sites be observed, KAM would notify the Archaeology Branch and consult with the Archaeology Branch in the development of appropriate mitigation measures to minimize further impacts, which may include detailed mapping, photography, systematic data recovery, or site capping.

19.5 DISCUSSION OF ISSUES

During the EA, SSN raised concerns related to potential effects to Indigenous heritage. This section provides a summary of key issues and KAM's responses.

19.5.1 INDIGENOUS HERITAGE

SSN submitted written reports to the Agency and EAO summarizing the outcomes of its community-based panel hearings, submitted written comments, and participated in numerous meetings with the Agency and EAO. SSN communicated the interconnectedness between environment and culture, the need for a more holistic approach to the EA which considers the importance of *Pípsell*, including the hunting blind complex, and the role of the Trout Children Story in SSN culture. SSN expressed their view that KAM's assessment of Indigenous heritage should have included intangible/invisible aspects of SSN heritage.

The hunting blind complex is an important aspect of *Pípsell*. SSN explained that the hunting blind complex encompasses a wider area than the petroforms identified by KAM. SSN has described multiple potential past uses for the hunting blind complex, including for hunters awaiting large game, a place of ceremony, and for vision questing. In modern day, SSN explained that the hunting blind complex is used as a tool for teaching, reinforcing cultural identity, and for maintaining a spiritual connection to the natural world. SSN has repeatedly referred to the hunting blind complex as a highly significant cultural resource of irreplaceable cultural value.

KAM has acknowledged the importance of *Pípsell* and the hunting blind complex to SSN and identified possible measures to mitigate effects to the hunting blind complex, including documentation and/or relocation.

SSN has indicated that removal and/or relocation of the hunting blind complex is unacceptable because of its importance to SSN's cultural heritage.

19.6 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

In consideration of KAM's proposed mitigation measures, the Agency and EAO are of the view that Ajax would result in residual effects to physical and cultural heritage.

19.6.1 ARCHAEOLOGICAL SITES

The Agency and EAO acknowledge that Ajax would directly affect 28 archaeological sites and has the potential to indirectly affect 18 additional sites, as well as previously unrecorded sites. The Agency and EAO note that KAM would be required to undertake all work in accordance with the *Heritage Conservation Act* and carry out all activities which would affect archaeological resources in compliance with any permits issued under the *Heritage Conservation Act.* For the majority of the sites, the Agency and EAO are of the opinion that systematic data recovery or site capping would be sufficient to ensure that Ajax minimizes adverse effects to those resources. In addition, the Agency and EAO consider KAM's proposed Chance Find Procedure to be sufficient for managing finds of previously unrecorded heritage resources. The Agency and EAO recommend that measures to record, date, retain, catalogue, and share this information should be undertaken by qualified individuals and in consultation with MFLNR.

After considering all relevant proposed mitigation measures, the Agency and EAO conclude that Ajax would result in residual effects to archaeological sites. The Agency and EAO consider the residual effects to be medium in magnitude because Ajax would affect intact portions of archaeological sites of low and moderate importance, local in geographic extent, and far future in duration. The effect would occur once during construction, and would be irreversible. Considering the above assessment, including the implementation of applicable mitigation measures, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects on physical and cultural heritage related to archaeological sites.

19.6.2 EARLY SETTLEMENT HERITAGE SITES AND PALEONTOLOGICAL RESOURCES

The Agency and EAO accept that Ajax has the potential to directly or indirectly affect 16 sites related to homesteading and settlement within the local study area. The Agency and EAO are of the opinion that appropriate mitigation measures are available to minimize adverse effects to these sites. The Agency and EAO recommend that measures to record, date, retain, catalogue, and share this information should be undertaken by qualified individuals and in consultation with the Heritage Branch.

After considering all relevant proposed mitigation measures, the Agency and EAO conclude that Ajax would result in residual effects to early settlement heritage sites. The Agency and EAO consider the residual effects to be minor in magnitude, because Ajax would affect sites of low archaeological importance, local in geographic extent, and far future in duration. The effect would occur once during construction, and would be irreversible. Considering the above assessment, including the implementation of applicable mitigation measures, the Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects on physical and cultural heritage related to early settlement heritage sites and paleontological resources.

19.6.3 INDIGENOUS HERITAGE

The Agency and EAO considered KAM's assessment of effects on Indigenous heritage, which focused on tangible aspects of heritage (e.g. archaeological sites). In addition, the Agency and EAO have considered SSN's description of the intangible/invisible aspects of heritage associated with the *Pípsell* area. The Agency and EAO acknowledge SSN's view that *Pípsell* is a cultural keystone area that is foundational to SSN's cultural identity and has intrinsic and intangible value. SSN has stated that effects to *Pípsell* cannot be mitigated. The Agency and EAO further acknowledge SSN's statements that the presence of the hunting blind complex is an integral part of the *Pípsell* cultural landscape, and that its value relies on its current location and functioning of the surrounding landscape. The Agency and EAO acknowledge SSN's view that the mitigation proposed by KAM to offset the loss of the hunting blind complex, including relocation of the hunting blind complex, creation of a 3D model, or other means of partially or fully preserving the structures associated with the hunting blind complex, would not mitigate the loss of the hunting blind complex nor the corresponding impacts to SSN heritage.

After considering all relevant proposed mitigation measures, the Agency and EAO conclude that Ajax would result in residual effects to Indigenous heritage. The Agency and EAO consider the residual effects to be high in magnitude, because Ajax would affect substantial portions of intact sites of high importance, regional in geographic extent, based on the impact on the entire SSN community, and far future in duration. The effect would occur once during construction, and would be irreversible.

The Agency and EAO's characterization of the residual effects of Ajax on heritage, as well as the level of confidence in the effects determination and the assessment of significance of the potential residual effects, are summarized in Appendix A.

19.6.4 CUMULATIVE EFFECTS

The Agency and EAO are of the view that past and present activities, primarily ranching and previous mining at the site, would contribute to cumulative effects on Indigenous heritage resources. Both the hunting blind complex and the *Pípsell* cultural landscape have been altered by previous mining and ranching activities. The existing effects from these other activities would occur in combination with the predicted effects of Ajax to the Indigenous heritage value of the hunting blind complex and the *Pípsell* cultural landscape. Cumulative impacts to heritage from other projects or activities in the regional study area are considered unlikely.

The Agency and EAO are of the opinion that cumulative effects to Indigenous heritage due to Ajax effects interacting with the effects of previous mining and ranching activities would be high in magnitude and irreversible.

19.6.5 CONCLUSION

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax is likely to cause significant adverse environmental effects to physical and cultural heritage due to effects to Indigenous heritage.

Taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency and EAO conclude that Ajax, in combination with past, present, and reasonably foreseeable future projects, is likely to result in significant adverse cumulative effects to physical and cultural heritage due to effects to Indigenous heritage.

20 Effects of Accidents and Malfunctions

20.1 BACKGROUND

This section provides a summary of potential effects of Ajax from accidents and malfunctions during construction and operation as identified by KAM, the mitigation measures proposed by KAM to address those effects, and a discussion of the key issues related to accidents and malfunctions raised during the EA. It also sets out the analysis and conclusions of the Agency and EAO regarding Ajax's potential adverse effects due to accidents and malfunctions.

The EAO notes that, following from the Independent Panel recommendations on the tailings storage facility breach at Mount Polley (see section 1.5 for further details), Part 10 of the Mining Code was updated on July 20, 2016 to include design standards for tailings storage facilities that are tailored to the particular conditions encountered in British Columbia and emphasize protecting the public and workers. These include tailings storage facility design requirements for the steepness of downstream slopes, the minimum static factor of safety, and new seismic and flood design criteria. Other updates include new operations criteria for tailings storage facilities, requiring water balance and water management plans for tailings storage facilities, and requiring mines with tailings storage facilities to establish Independent Tailings Review Boards.

20.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

KAM completed risk profiles for 57 types of accidents and malfunctions that may be caused by Ajax (Appendix C). Based on a risk assessment approach that considered magnitude, extent, and likelihood of effects, KAM determined that failure of the tailings storage facility and collapse of the open pit high wall posed a high risk due to the potential for catastrophic effects, and warranted further assessment, despite having very low likelihood of occurrence. The other accidents and malfunctions assessed were characterized as being of low or medium risk.

20.2.1 TAILINGS STORAGE FACILITY FAILURE

KAM assessed the potential types of tailings storage facility failures, including seismic events, differential settlement and cracking, and overtopping. The mine rock storage facilities provide substantial buttressing along the north and east embankments of the tailing storage facility. KAM's view is that this buttressing ensures a high consequence failure of these embankments is implausible. KAM also assessed the impacts of a failure of the south embankment, which is not buttressed by a mine rock storage facility.

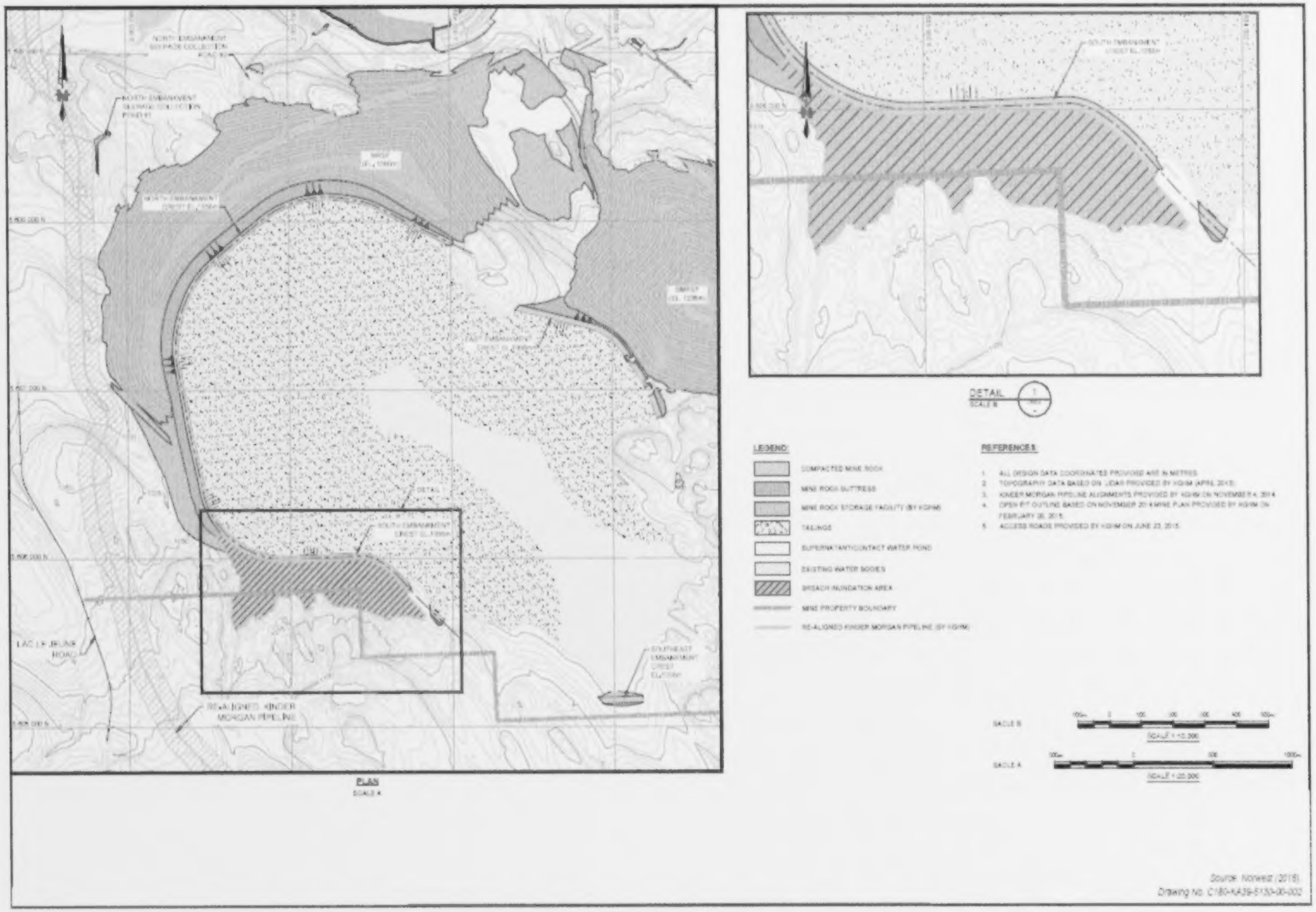
KAM did not assess a failure of the southeast embankment because it does not impound tailings and acts only to contain supernatant within the property boundary. The potential environmental effects of a failure of the south embankment would be much less severe than a failure of the north or east embankments due to the increased elevation to the south (outside the property boundary). The primary function of the southeast embankment is to limit the Ajax footprint to the property boundary.

KAM stated that a failure of the south embankment would have the highest consequence at year 20, when the tailings storage facility has the largest footprint. In this scenario, the area inundated with tailings could extend outside the mine property boundary and would be contained by surrounding topography to an area covering 32 hectares, as far as 300 m from the edge of the south embankment. KAM noted that this event would release tailings only, as supernatant would be located sufficiently far from the crest of the south embankment.

KAM contends that a failure of the south embankment would result in a slight increase in the Ajax footprint and the loss of 32 hectares of soil resources (Figure 9), which KAM determined to be a low magnitude effect. KAM stated that the extent of a south embankment failure would include an 8 hectare area that is part of an existing grazing licence and trapline. It is KAM's view that this effect would be of low magnitude because of existing limitations on recreational and ranching use due to the steep topography in this area. In addition, KAM concluded that effects to current use of lands and resources by Indigenous peoples would be of low magnitude because the area affected by the dam failure is not known to contain particularly unique habitat or ceremonial features.

KAM's assessment showed a seepage collection ditch and two sumps would likely be buried in the event of failure of the south embankment. KAM predicted that there would be no effects to downstream surface waters in the event of such a failure because the surrounding topography would contain the tailings.

Figure 9: Extent of Impact of Failure of the South Embankment.


NORTH EMBANKMENT SEEPAGE COLLECTION POND
NORTH EMBANKMENT SEEPAGE COLLECTION PONDS
NORTH EMBANKMENT
EAST EMBANKMENT
SOUTH EMBANKMENT
SOUTHEAST EMBANKMENT CREST
LAC LE JEUNE ROAD
RE-ALIGNED KINDER MORGAN PIPELINE
DETAIL
PLAN
SCALE A
DETAIL
SCALE B
LEGEND:
COMPACTED MINE ROCK
MINE ROCK BUTTRESS
MINE ROCK STORAGE FACILITY (BY KGHM)
TAILINGS
SUPERNATANT/CONTACT WATER POND
EXISTING WATER BODIES
BREACH INUNDATION AREA
MINE PROPERTY BOUNDARY
RE-ALIGNED KINDER MORGAN PIPELINE (BY KGHM)
REFERENCES
1. ALL DESIGN DATA COORDINATES PROVIDED ARE IN METRES.
2. TOPOGRAPHY DATA BASED ON LIDAR PROVIDED BY KGHM (APRIL 2013).
3. KINDER MORGAN PIPELINE ALIGNMENTS PROVIDED BY KGHM ON NOVEMBER 4, 2014
4. OPEN PIT OUTLINE BASED ON NOVEMBER 2014 MINE PLAN PROVIDED BY KGHM ON FEBRUARY 20, 2015.
5. ACCESS ROADS PROVIDED BY KGHM ON JUNE 23, 2015.
SCALE B
SCALE A
Source: Norwest (2015)
Drawing No. C180-KA39-5130-00-002

Source: EIS/Application – Figure 17.6-2 (Case Number 5 Inundation Extent – page 17.6-74)

KAM noted that mitigation for failure of the tailings storage facility is primarily through the design of the facility. The facility and operation plans were designed to reduce the volume of start-up water required to be stored and includes buttressing of the north and east embankments.

KAM will monitor the tailings storage facility and associated drainage and underlying substrate to reduce the risk of dam failure and to ensure the structure meets the Canadian Dam Association Dam Safety Guidelines[60] and the 2014 technical bulletin Application of Dam Safety Guidelines to Mining Dams. [61] KAM would also be required to meet the design standards for tailing storage facilities and associated infrastructure outlined in the Health, Safety, and Reclamation Code for Mines[62], and the Health, Safety, and Reclamation Code for Mines: Guidance Document.[63]

In the event of a tailings storage facility failure, KAM would follow the requirements outlined in section 1.7.1 of the Health, Safety, and Reclamation Code for Mines in BC[3] and Mine Emergency Response Plan: Guidelines for the Mining Industry.[64] As well, KAM would follow steps as outlined in the Ajax Risk Management Plan (Accidents and Malfunctions), which can include notification of stakeholders, evacuation, and remediation, as appropriate.

20.2.2 COLLAPSE OF OPEN PIT HIGH WALL

KAM assessed the potential failure of the pit wall resulting in the loss of Jacko Lake into the open pit. Because the western pit boundary is in close proximity of the eastern boundary of the lake, failure of the pit wall could result in the lake draining to the open pit. KAM characterized the consequence of such an event as having a catastrophic effect and a rare likelihood (i.e. not more than once in 10,000 years). The risk of occurrence would be least likely during the start of operation, and would increase as the pit rim advanced towards the lake.

KAM stated that if the worst case scenario were to occur and all of Jacko Lake was lost due to a sudden and complete collapse of the open pit high wall, 4.2 million cubic metres (Mm3) of water would flow into the open pit, and 48.5 hectares of lake habitat would be temporarily lost until the lake could be restored. The worst case scenario event could result in the loss of human life and would have high magnitude effects to local surface water, to water licence holders on and downstream of Jacko Lake, and to fish habitat in the lake.

In addition, KAM determined the loss of Jacko Lake would cause high magnitude effects to current use of lands and resources for traditional purposes by aboriginal persons due to the use of the lake by SSN for many current use activities, including fishing, hunting, gathering, and ceremonial practices. SSN has noted that even a temporary loss of Jacko Lake would result in permanent impacts to current use, as the cultural value of the lake to SSN is dependent upon the lake being undisturbed.

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[60] Canadian Dam Association. 2007 (updated 2013). Dam Safety Guidelines

[61] Canadian Dam Association. 2014. Application of Dam Safety Guidelines to Mining Dams

[62] British Columbia Ministry of Energy and Mines, 2017. Health, Safety, and Reclamation Code for Mines

[63] British Columbia Ministry of Energy and Mines, 2016. Health, Safety, and Reclamation Code for Mines: Guidance Document

[64] British Columbia Ministry of Energy and Mines, 2013. Mine Emergency Response Plan: Guidelines for the Mining Industry

KAM indicated that ranch operators, recreational users, and archaeological sites would also experience effects of a low magnitude, including temporary loss of use of affected areas during restoration activities.

KAM identified mitigation measures, through project design and monitoring, to prevent open pit high wall failure and loss of Jacko Lake which included:

- Detailed geotechnical investigations and conservative design;
- Horizontal drains to depressurize the pit wall to reduce the likelihood of failure;
- Active and continuous monitoring of pit wall stability;
- Adaptive management including reinforcement of the pit wall or evacuation if required;
- Continual optimization of the mine plan to ensure the long-term stability of the pit wall; and
- A buttressed pit wall via an in-pit mine rock storage facility to reduce residual risk.

In the event of a pit wall failure, KAM indicated that the following reactive measures would be implemented:

- Emergency response plans would be implemented to establish safe conditions as soon as possible;
- Site investigations would be undertaken to evaluate the new geotechnical conditions and the resultant effects to environmental and cultural resources;
- The lake would be re-established, including constructing new dams, sealing potential seepage pathways, re-filling the lake (with original lake water, if possible, or with supply from Kamloops Lake), and re-establishing water supply to downstream users and fish population; and
- A new stability monitoring plan would be developed and implemented to incorporate new site conditions. Follow-up monitoring would include monitoring the stability of the new dam(s) and verifying the success of re-establishing the lake.

The Agency and EAO note that the pit design and related mitigations for accidents and malfunctions involving the pit wall would be subject to review during the permitting process, if Ajax proceeds, and finalized under a joint *Mines Act* and *Environmental Management Act* permit process[65] as well as under the Health, Safety, and Reclamation Code for Mines in BC.[66]

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[65] For more information on mine permitting under the mines act and the Environmental Management Act please see: http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/permitting/minesact-ema_application_information_requirements_feb2016.pdf

[66] To review the Health, Safety, and Reclamation Code for Mines in BC see: http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/health-and-safety/code-review/health_safety_and_reclamation_code_2017.pdf

20.2.3 RELEASE OF HYDROCARBON FROM THE TRANS MOUNTAIN PIPELINE INTO JACKO LAKE

The relocated TMX pipeline would cross the private section of the mine access road and run adjacent to the north embankment of the tailings storage facility. While the responsibility for the pipeline lies with Kinder Morgan, KAM assessed the effects of pipeline failure on Ajax. Failure of the pipeline could result in the release of hydrocarbon into Jacko Lake, and Lower Peterson Creek resulting in effects to surface water, sediment quality, groundwater quality, and fish and fish habitat. KAM characterized failure of the pipeline and release of hydrocarbons into Jacko Lake as a rare event (1 in 10,000 year), given that the pipeline is buried, and includes a leak detection system and would need to travel 1 km over or through hilly terrain to reach Jacko Lake.

Should Ajax be constructed, KAM would establish a communication protocol with Kinder Morgan Canada to ensure it receives any information relevant to the pipeline, including reports of any leaks and spills. In the event of a hydrocarbon spill, KAM would close the outlet on Jacko Lake, implement the Emergency Response Plan and Fire Hazard Abatement Plan, and support Kinder Morgan in response procedures. KAM would undertake water quality monitoring in Jacko Lake prior to re-establishing discharge to Peterson Creek.

20.2.4 CUMULATIVE EFFECTS

The Agency and EAO consider cumulative effects resulting from accidents and malfunctions to be those effects resulting from interactions between Ajax and other existing or reasonably foreseeable projects or activities. A tailings dam failure at the Ajax site could interact with the Trans Mountain pipeline. KAM determined such interaction to be low risk (see Appendix C), and does not anticipate residual cumulative effects.

20.2.5 MONITORING AND FOLLOW-UP

KAM will actively monitor geotechnical and hydrogeological conditions at the tailings storage facility and open pit as described in KAM's Risk Management Plan (Accidents and Malfunctions).

20.3 DISCUSSION OF ISSUES

During the review period, members of the working group and members of the public raised concerns related to the potential for accidents and malfunctions to impact the environment and nearby communities. This section provides a summary of the key issues raised and KAM's responses.

20.3.1 TAILINGS STORAGE FACILITY FAILURE

During the public comment period on the EIS/Application, several thousand comments were received from members of the public, community groups, and the City of Kamloops. These comments frequently expressed concern relating to a failure of the tailings storage facility and associated environmental and safety impacts. Public comments included concerns that a complete failure of the north or east tailings embankments would cause widespread damage of property, impacts to waterways including the Thompson River, and major loss of life in Kamloops. Comments received also stated that the possibility of such a failure, however unlikely, posed too great a risk to area residents, ecosystems, and ways of life.

KAM responded by providing further information on the steps taken to design a tailings storage facility that is safe and capable of handling loads several times greater than the expected conditions in order to exceed the minimum design requirements of MEMPR and the Canadian Dam Safety Guidelines.[67] The design features, identified by KAM, that would prevent failure of the tailings storage facility included buttressing of embankments, increasing dam capacity to withstand the maximum probable flood, and providing sufficient dam freeboard (height of the dam above the water line).

The public raised concern with the validity of the geotechnical investigations that characterized the materials underlying the tailings storage facility. They asserted that KAM's investigations may not have been sufficiently thorough to accurately characterize the area, which would result in an underestimated risk of a tailings dam failure. KAM responded that it was confident in its assessment because it was conducted by an experienced team of qualified professionals and was undergoing third party review by technical experts.

MEMPR and the City of Kamloops indicated that they did not have concerns about the safety of the design of the tailings storage facility. SSN's geotechnical expert also indicated that the tailings storage facility design was safe.

SSN and members of the public raised the issue of financial liability in the event of an accident or malfunction. Specifically, there were questions regarding financing of post-accident restoration activities, methods for assessing the adequacy of contingency actions, and how any unfunded liability would be managed. KAM responded that it would be liable and responsible for clean-up and remediation should an accident or malfunction event occur, noting that estimations of the economic cost of such events is beyond the scope of the EA. KAM noted that response protocols have been captured in the EIS/Application and that development of further details and consultation will occur as Ajax progresses.

Members of the public questioned whether the reclamation bond (required as part of a *Mines Act* permit) would cover catastrophic events such as the 2014 tailings dam failure at Mount Polley. MEMPR further clarified that the security (i.e. reclamation bond) required to issue a *Mines Act* permit covers the costs of preventative measures such as maintenance, monitoring, and improvements to mitigation measures, but does not address off site clean-up costs.

20.3.2 COLLAPSE OF OPEN PIT HIGH WALL

Members of the public and SSN expressed concern about the possibility of a pit lake wall failure resulting in a loss of Jacko Lake. Concerns focused around the effects of such a failure to fish and fish habitat, recreation, and overall ecosystem health. KAM responded by highlighting the results of its assessment, which support its conclusions there was a low likelihood of such an accident and malfunction.

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[67] Canadian Dam Association. 2007 (updated 2013). Dam Safety Guidelines

SSN requested that long-term pumping tests be conducted to further define the hydraulic connection between Jacko Lake and the open pit, and to better understand and avoid the risk of a potential pit high wall failure. KAM committed to undertaking additional hydrogeological investigations in this area, including additional pumping tests, in support of subsequent permit applications. The EAO proposes an EA Certificate condition requiring that these investigations be undertaken, prior to the commencement of construction, and the results of these investigations further inform a subsequent Surface Water and Groundwater Monitoring and Management Plans.

20.3.3 OTHER CONCERNS

SSN commented that KAM's assessment of effects from accidents and malfunctions did not adequately characterize effects to SSN community health and wellbeing. KAM responded that the purpose of its assessment is to characterize and propose mitigation for direct effects of potential accidents and malfunctions, and that community health and wellbeing effects could be considered in the Emergency Response Plan.

The Trans Mountain pipeline currently runs through the Ajax site, and would be rerouted to avoid Project infrastructure. SSN recommended that KAM be required to submit further information regarding the effects of a potential spill from the pipeline, specifically the effects of a spill not located directly near Jacko Lake. KAM stated that Ajax would not cause such a spill, and that the pipeline and its effects are the responsibility of Trans Mountain and were recently assessed by the National Energy Board. Failure of the Trans Mountain pipeline is discussed further in section 22.

The City of Kamloops expressed concern about the effects of contact water potentially mixing with non-contact water and resulting in effects to aquatic life and country foods downstream. KAM determined that water management failures represented a low risk (see Appendix C) for effects of repeated small spills. In addition, the City of Kamloops raised concerns about the effects of fuel spills. KAM considered effects of accidental spills related to fuel storage and transport in its effects assessment (see Appendix C). KAM committed to following best management practices for water management. The EAO proposes EA Certificate conditions requiring that KAM develop surface and groundwater management and monitoring plans prior to construction.

20.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

The Agency and EAO are satisfied that KAM adequately identified and assessed the potential accidents and malfunctions associated with Ajax. KAM proposed measures to avoid or prevent potential accidents and malfunctions including project design and a monitoring plan, through which contingency and response plans would be in place, should an accident or malfunction occur.

The Agency and EAO acknowledge there is a high level of government and public concern regarding the potential for a tailings dam failure, in consideration of the consequences of the Mount Polley tailings facility breach in 2014. The EAO notes that, following from the Independent Panel recommendations on the tailings storage facility breach at Mount Polley, Part 10 of the Mining Code was updated on July 20, 2016 to include design standards for tailings storage facilities that are tailored to the particular conditions encountered in BC and emphasize protecting the public and workers. These include tailings storage facility design requirements for the steepness of downstream slopes, the minimum static factor of safety and new seismic and flood design criteria. Other updates include new operations criteria for tailings storage facilities, requiring water balance and water management plans for tailings storage facilities and requiring mines with tailings storage facilities to establish Independent Tailings Review Boards. Ajax will be designed, operated, and monitored from a compliance and enforcement perspective consistent with the new regime.

Taking into account the mitigation measures and project design proposed by KAM, the contingency and response plans committed to by KAM, the low likelihood of occurrence of either a tailings storage facility or pit wall breach, and the regulatory requirements under the *Mines Act,* the Agency and EAO are of the view that Ajax is not likely to cause significant adverse environmental effects as a result of accidents or malfunctions.

21 Effects of the Environment on the Project

21.1 BACKGROUND

This section provides a summary of the assessment of potential effects of the environment on Ajax. The former Act requires the federal EA to consider the environmental effects of any change to the project that may be caused by the environment.

Potential effects of the environment on Ajax include: heavy precipitation, lightning and wildfires, high winds, changes to surface water flows, geophysical events (seismic events, slope stability and mass wasting events), and climate change.

21.2 KAM'S ASSESSMENT OF EFFECTS AND MITIGATION

This section provides a summary of KAM's identification and assessment of potential effects of the environment on Ajax, and its proposed mitigation.

21.2.1 HEAVY PRECIPITATION

KAM evaluated the effects of 24 hour heavy precipitation events including 1 in 10 year, 1 in 25 year, 1 in 200 year, and probable maximum precipitation events. Heavy precipitation events could result in overtopping of containment structures (tailings storage facility, sediment ponds, seepage collection ponds), flooding, erosion, washing out of trees, and damage to site infrastructure (buildings and access roads).

The worst-case scenario following a heavy precipitation event would be flooding leading to catastrophic failure of the tailings storage facility embankment and uncontrolled release of tailings into the wider environment. KAM indicated that the tailings storage facility would be designed, constructed, operated, and decommissioned in accordance with the Canadian Dam Association Dam Safety Guidelines. In particular, the tailings storage facility would be designed with additional freeboard such that the dam would be able to contain tailings, water from a probable maximum flood event (a flood event that has an approximate return period of between 1 in 10,000 and 1 in 1,000,000 years), and wave run-up
(i.e. movement of tailings/water up a dam from breaking waves).

Mitigation for a heavy precipitation event would include maintenance of drainage structures, crossing structures, and roads; regular clearing of ditches and culverts; and use of appropriate design criteria for different project components. In the event of a heavy precipitation event contributing to an emergency scenario (i.e. catastrophic failure of the tailings storage facility), the Emergency Response Plan would be initiated which includes notification of appropriate personnel and evacuation, if appropriate.

21.2.2 LIGHTNING AND WILDFIRES

Ajax area has an average of 10 days with lightning each year, with lightning occurring more often during the summer months and during evenings. Lightning can lead to forest fires, damage infrastructure, and create unsafe outdoor working conditions. KAM would use a lightning monitoring device to monitor strikes and suspend project activities during high risk times, if appropriate. Other mitigation measures would include constructing, operating and maintaining project components in compliance with the appropriate electrical and fire code, equipping vehicles with firefighting tools, and locating firefighting tools around the Ajax area.

Ajax is located within an area characterized by frequent fires. To mitigate the potential effects from wildfires, KAM would implement the Fire Hazard Abatement Plan, manage vegetation to limit fuel for the fire, equip vehicles with firefighting tools, locate firefighting tools around Ajax, ensure that water sources have adequate water pressure for use in fire suppression, and provide backup generators for use in the event of a power outage.

21.2.3 HIGH WINDS

High winds could knock down trees which, in turn, could block roads or lead to power outages. High winds during the summer could increase wildfire intensity, while high winds in the winter could increase wind chill, interfere with visibility, and result in snowdrifts. During power outages, KAM would shut down non-essential equipment and machinery and use an alternate power source for essential equipment and machinery.

21.2.4 SURFACE WATER FLOW

Rivers in the area are predominantly fed by spring and summer snowmelt with lower flows in the remainder of the year. Since the Ajax site already has a soil moisture deficit, low flows are exacerbated during periods of low precipitation.

Low water flow conditions would increase reliance on water supply from Kamloops Lake and decrease water availability for diluting contact water after release into the environment. These effects would result in decreased water quality in receiving environments and affect quality of aquatic habitat. Mitigation measures would include isolation of contact and non-contact water and re-using as much process water as possible.

High flow conditions in the region are generated predominantly by rapid snowmelt during freshet, and also by rain falling on melting snow during freshet or early winter. These high flow conditions could cause flooding and overtopping of containment structures which, in turn, can cause erosion, sediment deposition, mass wasting events, and damage to site infrastructure such as washing out of drainage structures. To mitigate potential effects, KAM would locate Ajax infrastructure above the 100-year flood level, and construct Ajax infrastructure to appropriate design criteria. The tailings storage facility would be designed and constructed to withstand a 24 hour probable maximum flood event.

21.2.5 GEOPHYSICAL EVENTS

KAM evaluated the potential for liquefaction in the tailings storage area and subsidence throughout the Ajax area due to seismic activity and concluded that both events are highly unlikely. KAM identified a few areas within the Ajax footprint and along the transmission line corridor as potentially unstable (i.e. areas that have a moderate likelihood of landslide following timber harvesting and road construction), and identified additional areas with the potential for gully erosion. Environmental effects resulting from instability could include erosion and sedimentation. KAM committed to undertake a slope stability assessment prior to disturbance of any slope that is at least 37 degrees, and to develop mitigation measures following the slope stability assessment. In addition, KAM would develop erosion control plans prior to disturbance of areas where gully erosion is evident.

21.2.6 CLIMATE CHANGE

As the climate in the Ajax area is expected to become warmer, annual evaporation, precipitation, and the frequency and magnitude of extreme weather are all expected to increase. Earlier onset of snowmelt is expected to increase flows in March and April and decrease flows in May and June. Overall, KAM predicted that annual runoff would increase 19% at Jacko Lake and 25% at the PC02 monitoring station over the next 100 years (i.e. into post-closure) due to increased precipitation. In general, climate change is expected to increase precipitation which would partially offset the effects of Ajax on water flow. As described in sections above, KAM designed Ajax components to withstand heavy precipitation, changes to surface water flows, changes to wildfire frequency and other climate change-related effects. In addition, KAM would implement an adaptive management approach to address changing environmental conditions.

21.3 DISCUSSION OF ISSUES

During the EA, members of the public and community groups expressed concern about the effects of the project being exacerbated by changing environmental conditions. The comments specifically referenced concerns about the effects of major floods on the tailings storage facility. KAM responded that the tailings storage facility would be designed to accommodate a probable maximum flood event (a flood event that has an approximate return period of between 1 in 10,000 and 1 in 1,000,000 years).

A comment also indicated concerns regarding the effects of climate change on Kamloops Lake. KAM determined that Ajax's water withdrawal from Kamloops Lake would not be measurable at the lake outlet in both current conditions and when taking future climate change predictions into account.

21.4 ANALYSIS AND CONCLUSIONS OF THE AGENCY AND EAO

The Agency and EAO are satisfied that KAM has adequately identified and considered the potential effects of the environment on Ajax. The Agency and EAO agree with KAM that appropriate design, best management practices, and adaptive management would be sufficient to address these effects.

22 Effects on Capacity of Renewable Resources

Under section 16(2)(d) of the former Act, a comprehensive study must consider the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.

Renewable resources that may be affected by Ajax include water resources, freshwater fish and fish habitat, rare and sensitive ecosystems, grasslands, and terrestrial resources. Significant adverse effects on these renewable resources could result in a reduced capacity to support sustainable fishing, hunting, harvesting and other renewable resource based activities. Each of these renewable resources was assessed in previous sections of the Report.

Considering the above assessment and taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, the Agency concludes that Ajax is not likely to cause significant adverse environmental effects to the capacity of renewable resources.

Part C – Consultation with Indigenous Groups

23 Approach to Consultation with Indigenous Groups

23.1 INDIGENOUS GROUPS CONSULTED

Ajax would be located within the asserted traditional territories of Tk'emlúps te Secwépemc (Tk'emlúps Indian Band) and Skeetchestn Indian Band, who were jointly represented by SSN in the EA. Ajax would also be located in the asserted traditional territories of Whispering Pines/Clinton Indian Band (Whispering Pines/Clinton), Ashcroft Indian Band (Ashcroft), and Lower Nicola Indian Band (Lower Nicola).

On behalf of the federal Crown, the Agency also understands that Métis Nation British Columbia (MNBC) asserts Aboriginal rights on behalf of its chartered communities across the province, and that there are three Métis communities in the vicinity of Ajax that may be impacted.[68]

Section 23 of this Report provides an overview of the Agency's and EAO's respective consultation processes and joint consultation activities. For each Indigenous group potentially impacted by Ajax, the subsequent sections of this Report (sections 24-28) provide a description of the following: the Agency's and EAO's consultation activities; the asserted or established Aboriginal rights, including title, (Aboriginal Interests) that could potentially be impacted; the seriousness of potential impacts on Aboriginal Interests; and, the measures to avoid, mitigate, or otherwise accommodate such impacts.

For a detailed description of Ajax and its location, see Part A of this Report.

23.2 OVERVIEW OF FEDERAL AND PROVINCIAL CONSULTATION PROCESSES

The Crown has a duty to consult Indigenous groups and, where appropriate, to accommodate, when it has knowledge that its proposed conduct might adversely impact an asserted or established Aboriginal or Treaty right. Consultation is also undertaken more broadly as an important part of good governance, meaningful policy development and informed decision-making. For the federal Crown, the Agency fulfilled the role of Crown Consultation Coordinator on behalf of the federal responsible authorities.

Where practicable, the Agency and EAO endeavoured to conduct joint consultation activities. This was intended to increase efficiency and to reduce the consultation burden on Indigenous groups that both the Agency and

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[68] The Province of British Columbia does not recognize a legal obligation to consult with Métis people, as the Province is of the view that no Métis community is capable of successfully asserting site specific section 35 rights in BC.

EAO identified as potentially impacted. Throughout the EA process, the Agency and EAO were mindful of the duty to consult and of their respective commitments to Indigenous groups.

The Crown is legally obligated to consult on and, where necessary, accommodate asserted or established Aboriginal rights, including title, which may be impacted by federal and/or provincial decisions. In *Haida Nation v. British Columbia* (Minister of Forests), 2004 SCC 73 (*Haida*), the Supreme Court of Canada describes the extent (or level) of the Crown's obligation to consult as lying on a spectrum from notification to deep consultation. The extent (or level) of consultation required is proportionate to preliminary assessments of the following factors:

- Strength of the case for the claimed Aboriginal rights (including title) that may be adversely affected; and
- Seriousness of the potential impact of contemplated Crown action or activity on Aboriginal Interests.

The EA process is not a rights determining process in relation to asserted Aboriginal rights or title. Instead, a key objective of an EA is to identify potential adverse impacts of proposed projects on Aboriginal Interests and to identify measures to avoid, mitigate, or otherwise appropriately address such impacts. Under the former Act, per the definition of environmental effects, the federal government also has a responsibility to consider the effect of any changes to the environment caused by a project on the current use of lands and resources for traditional purposes by aboriginal persons. This assessment is presented in section 18 of this Report.

Upon receipt of the draft Project Description in 2011, the Agency and EAO each undertook a preliminary analysis of which Indigenous groups may be impacted, and the extent of that potential impact, based on the two factors referenced above. This preliminary analysis resulted in separate depth of consultation assessments, following each government's established consultation policy. The depth of consultation determined the types of consultation opportunities offered to Indigenous groups by the Agency and EAO.

The Agency and EAO consulted SSN at the deep end of the *Haida* consultation spectrum. Ashcroft and Lower Nicola were offered consultation opportunities consistent with the moderate level of the *Haida* consultation spectrum. The EAO provided notification of key project milestones to Whispering Pines/Clinton and the Agency consulted Whispering Pines/Clinton at a moderate level. The Agency consulted MNBC on behalf of its chartered communities at the low end of the *Haida* consultation spectrum. Please see sections 24-28 of this Report for further information about the nature of consultation activities, and information pertaining to the assessment of potential impacts on each Indigenous group's asserted Aboriginal rights.

Due to the collective nature of rights assertions made by certain Indigenous groups identifying themselves as part of the Secwépemc Nation or the Nlaka'pamux Nation, in 2011 the Agency and EAO separately contacted a number of additional Indigenous groups to provide them with an opportunity to participate in the EA and to request their feedback. The following Secwépemc Nation groups were contacted: Adams Lake Indian Band, Bonaparte Indian Band, High Bar First Nation, Little Shuswap Lake Indian Band, Neskonlith Indian Band, Simpcw First Nation, and Splatsin Indian Band. The following Nlaka'pamux Nation groups were contacted: Boothroyd Indian Band, Boston Bar First Nation, Coldwater Indian Band, Cook's Ferry Indian Band, Kanaka Bar Indian Band, Lytton First Nation, Nicomen Indian Band, Nooaitch Indian Band, Oregon Jack Creek Indian Band, Shackan Indian Band, Siska Indian Band, Skuppah Indian Band, and Spuzzum Indian Band. The Agency did not receive a response from any of these groups, and as a result sent a follow-up letter to each of the groups in February 2013 advising them that the Agency had concluded that they did not wish to participate in the EA process for Ajax, nor be engaged in any further consultation. The Agency offered to discuss any concerns related to this conclusion. The

EAO followed up on the original correspondences later in 2011, informing these groups that they would not be consulted during the EA.

The Agency and EAO integrated consultation activities into the EA process to the greatest extent possible. Joint activities included working group meetings; joint consultation meetings involving SSN, the Agency, and the EAO; and, consultation on a draft copy of this Report. Consistent with their respective consultation policies and approaches, the Agency and EAO also separately consulted Indigenous groups through a variety of methods including phone calls, emails, letters, and in-person meetings, regularly communicated to provide updates on key developments and to solicit input or feedback, and tracked written comments from most of the identified Indigenous groups on EA and consultation documents.

Further information about how each Indigenous group participated in these key EA milestones is located in the appropriate sections further on in this Report.

See the EAO working group table for additional information regarding issues raised by Lower Nicola and Ashcroft and the Provincial SSN Tracking Table for additional information regarding issues raised by SSN (both available at https://projects.eao.gov.bc.ca/p/ajax-mine/docs?folder=1).

23.2.1 AGENCY: INTEGRATING CONSULTATION INTO THE EA

The Agency's consultation activities, including proposed commitments, are set out in Consultation Approach documents, which are tailored to each group according to the assessed depth of consultation, and amended according to feedback from the respective Indigenous group.

The Agency supports the participation of Indigenous groups through its Participant Funding Program. Funds were made available to reimburse eligible expenses of Indigenous groups that participated in the EA. Six Indigenous groups applied for and were allocated funding through this program: Skeetchestn Indian Band ($102,000), Tk'emlúps te Secwépemc ($147,050), Ashcroft ($24,800), Lower Nicola ($30,150), Whispering Pines/Clinton ($40,000), and MNBC ($25,700).

23.2.2 EAO CONSULTATION PROCESS OVERVIEW

Section 11 of BC's *Environmental Assessment Act* enables the EAO to define the scope of project components and activities, the scope of the assessment, and the consultation requirements. The EAO issued an order under section 11 on January 11, 2012, that specified the consultation activities that the EAO and KAM would undertake with each of the Indigenous groups identified as potentially being affected by Ajax.

The EAO supports the participation of Indigenous groups through providing capacity funding. EAO capacity funding was provided to the following groups: Skeetchestn Indian Band ($5,000), Tk'emlúps te Secwépemc ($5,000), SSN ($40,000), Ashcroft ($15,000), and Lower Nicola ($15,000). To support SSN's participation in cross-provincial government EA and permitting consultation processes related to Ajax, the Province also provided $200,000 to SSN.

23.3 FEDERAL AND PROVINCIAL APPROACHES TO ASSESSING THE SERIOUSNESS OF POTENTIAL IMPACTS ON ABORIGINAL RIGHTS AND TITLE

The Agency and EAO each conducted an assessment of the seriousness of impacts on Aboriginal Interests for each Indigenous group identified as being potentially impacted by Ajax. The Agency and EAO worked together to ensure that the same information was being considered by each government to inform the final assessment. The following information sources were considered by both governments:

- Information provided by Indigenous groups regarding the nature of their Aboriginal Interests, and how their Aboriginal Interests may be impacted by Ajax;
- *Indigenous knowledge;*
- Information contained in KAM's EIS/Application;
- Information contained in Part B of this Report regarding environmental effects; and
- Input from Indigenous groups regarding the Crown's assessment of project impacts on Aboriginal Interests, as described in this Report.

In assessing the seriousness of potential impacts on Aboriginal Interests, the Agency and EAO considered the following common factors:

- The location of each Indigenous group's asserted traditional territory;
- Past, present, and anticipated future uses of the project area and its surroundings by Indigenous groups, including the frequency and timing of such uses by each Indigenous group;
- The baseline conditions associated with the exercise of Aboriginal Interests, including a consideration of other activities or development in the local or regional area in proximity to Ajax;
- The potential impact of project components and activities on Aboriginal Interests, including consideration of magnitude, geographic extent, duration, frequency, reversibility, probability, and overall level of confidence in the assessment;
- The efficacy of measures proposed to mitigate (e.g. avoid or minimize) adverse effects to biophysical aspects corresponding with Aboriginal Interests, and, where necessary, specific mitigation measures in relation to effects to Aboriginal Interests not directly linked to a biophysical aspect;
- Any residual and cumulative effects of Ajax to biophysical aspects associated with the exercise of Aboriginal Interests;
- The extent to which Ajax would affect each Indigenous groups' access to and use of the project area to exercise Aboriginal Interests;
- The relative importance of the project area and its surroundings to the exercise of each group's Aboriginal Interests, including any special characteristics or unique features of that area; and
- The relative availability and suitability of other areas in reasonable proximity, within the asserted traditional territory of each Indigenous group.

The assessment of the seriousness of a potential impact on Aboriginal Interests considers likely adverse residual effects that could cause a change to the practice of a right, whether deemed significant or not, after mitigation measures are applied. The outcome of this assessment is an impact statement that describes the level of seriousness of potential impacts from negligible to serious. The following definitions are used in this Report for the level of seriousness of potential impacts on Aboriginal Interests:

- Negligible: no detectable impact or any change from current conditions;
- Minor: ability to exercise the right is minimally disrupted;
- Moderate: ability to exercise the right has been diminished or disrupted; and
- Serious: ability to exercise the right has been significantly diminished.

In some instances, the Agency and EAO have used hyphenated levels of impacts (e.g. minor-to-moderate), which indicate that the impacts fall between the two categories. The Agency and EAO acknowledge that the impacts on an Indigenous group may vary in time and space; that is, impacts on Aboriginal Interests in one area of a group's asserted traditional territory may not be the same as elsewhere, and impacts may not be the same across different project phases. The level of seriousness that the Agency and EAO found for the potential impacts on Aboriginal Interests for each group reflects the greatest expected impact on the Aboriginal Interest as a result of Ajax.

24 Stk'emlupsemc te Secwépemc Nation

24.1 CONTEXT

24.1.1 GENERAL BACKGROUND

Jointly represented by SSN, the Tk'emlúps te Secwépemc (Tk'emlúps Indian Band) and the Skeetchestn Indian Band are the closest Indigenous groups to the mine site. Ajax is centrally located within SSN's 16,780 km^2 asserted traditional territory.

As of May 2017, Tk'emlúps te Secwépemc has a total registered membership of 1,340, of whom approximately 554 are living on one of six Tk'emlúps te Secwépemc reserves. Kamloops Reserve No. 1 is the largest (13,227.2 hectares), located immediately northwest of the City of Kamloops. The other reserves range from 3 hectares to 73 hectares; population data are not available for these reserves. Tk'emlúps te Secwépemc is governed by a Chief and seven Councillors. Band services and support are provided by 14 departments.

As of May 2017, Skeetchestn Indian Band has a total registered membership of 539, of whom approximately 224 live on one of four Skeetchestn reserves. The Skeetchestn reserve, located approximately 50 km west of the City of Kamloops, is the largest (7,975.7 hectares) and most populated. The three other reserves range in size from 2 hectares to 62.7 hectares and have unknown populations. Skeetchestn Indian Band is governed by a Chief and five Councillors.

Tk'emlúps te Secwépemc and Skeetchestn Indian Band are ethnographically recognized as part of the 'Kamloops Division' of the Secwépemc and work together under the traditional governance model of the Stk'emlupsemc te Secwépemc Nation, founded in Secwépemc law. In 2007, the Tk'emlúps te Secwépemc and Skeetchestn Indian Band entered into a Resource Sharing Protocol Memorandum of Understanding (MOU), setting out SSN's responsibility for managing conservation policies and natural resources within both nations' traditional territory, leading negotiations with governments and industry, and promoting the economic development of the SSN people. SSN is governed by the SSN Joint Council that is made up of the members of the chiefs and council from both Indigenous groups.[69]

Given the nature and location of Ajax and the potential impacts of Ajax on SSN's Aboriginal Interests, the Agency and EAO are of the view that the duty to consult SSN lies at the deep end of the *Haida* consultation spectrum.

24.1.2 LANGUAGE, CULTURE AND LAND STEWARDSHIP

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[69] In a letter to the EAO on February 20, 2015, SSN requested that the section 11 order be amended so that the definition of First Nation refers to SSN and not the individual bands that SSN represents, stating that the division is the traditional form of governance for SSN. An order was issued under section 13 making that change on April 28, 2016.

The following section provides an overview of the Agency and EAO's understanding of SSN's language, culture, and land stewardship. The discussion is based on reports, presentations and letters provided by SSN and available ethnohistoric literature. SSN also provided the Agency and EAO with the results of their community-based assessment (SSN Decision Package).

Secwépemc are the northernmost Salish-speaking Indigenous group in the Interior Plateau region and speak the Western dialect of *Secwépemcstsín*. During the Ajax EA, SSN prepared a Cultural Heritage Study that describes how within the Secwépemc worldview, all living organisms are of equal importance and a part of an interconnected web, thus it is not possible to rate the importance of any single species.[70] SSN communicated that Secwépemc spirituality embraces the connection to and respect for all living things. The Agency and EAO understand that the Secwépemc believe that spiritual powers reside in all parts of the universe and nature; thus, animals, plants and all parts of the landscape are considered alive.

SSN's Cultural Heritage Study describes how Secwépemc people participated in a seasonal harvesting round that relied on a connection to the land and its resources and included an understanding of how animals and plants behaved and how that behaviour changed according to the season and the location.[71] SSN's Cultural Heritage Study identifies five major seasons as part of the seasonal round: early spring (snow melting), mid-to-late spring (root gathering), summer (berry and high elevation root and medicinal plant gathering), late summer to early fall (salmon season) and mid to late fall (hunting season). SSN's Cultural Heritage Study also provides information about Secwépemc historical use of copper and gold, including trading copper.

SSN's Cultural Heritage Study also describes Secwépemc lands as collectively held by all members. SSN has described that, although all Secwépemc members had an equal right to access lands and natural resources to meet their needs, under Secwépemc law, certain groups such as SSN, are responsible for the stewardship and active management of specific tracts where they live and where they conduct most of their hunting, fishing, gathering of plants, and trapping. SSN has also communicated that the privatization of lands and resources (including mineral rights) following the arrival of Europeans contradicted the Secwépemc cultural value of shared access and stewardship. Privatization also contradicted Secwépemc laws that are embodied in *stseptékwll* (oral histories), and that describe Secwépemc as the owners, decision makers, and managers of these areas.

According to SSN, Secwépemc culture, laws, and governance structure are documented and shared through *stseptékwll*, some of which are tied to specific locations on the landscape. The Agency and EAO understand that Secwépemc *stseptékwll* are culturally important for SSN, as the stories link the past and present of *Secwépemcúlecw*, sharing moral, spiritual, legal and social values as well as knowledge. SSN has stated that these oral histories and the associated ancient markings on the land symbolize Secwépemc law. *Stseptékwll* also demonstrate and communicate the social, moral and natural consequences of past ancestors' actions. According to SSN, *stseptékwll* are one of the means by which traditional ecological knowledge is transmitted through generations.

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[70] Ignace, M. (2014) Cultural Heritage Study – Final Report
[71] *Ibid.*

24.1.3 *PÍPSELL AND THE TROUT CHILDREN STSEPTÉKWLL*

SSN has communicated that the proposed site for Ajax is in an area encapsulated by a *stseptékwll*, the Trout Children Story, and is connected to the Sky World, Earth World and Underground, and the Water World. The area, known as *Pípsell* (small trout), includes Jacko Lake and the surrounding area including the grasslands and the habitats of the red headed woodpecker and the chickadee. *Pípsell* also includes petroforms identified by SSN as part of a hunting blind complex, Goose Lake, Peterson Creek, a prayer tree identified as *K'ecúseu* (tears welling up in someone's eyes), and *X7ensq't* (described below). SSN communicated to the Agency and EAO that *Pípsell* is of significant cultural and spiritual importance and that under Secwépemc law, they are responsible for the ongoing stewardship of this area.

SSN has said that the Trout Children Story expresses a fundamental Secwépemc law that is the need for reciprocal accountability between humans and the environment (land, creatures, water resources and cycles, atmosphere). SSN also stated that given *Pípsell*'s importance as the site of the Trout Children Story, it is an irreplaceable cultural keystone place and that many of the activities practiced there cannot be relocated elsewhere as they are infused with, and informed by, the site-specific learnings in the Trout Children Story.

Petroforms, identified by SSN as the only known intact hunting blind complex in their asserted traditional territory, are also located in *Pípsell*. This complex includes a number of man-made rock features that are integrated into the distinct natural landscape to facilitate the group hunting of ungulates. SSN communicated that, given the geographic characteristics of the location and design of the complex, it was mostly likely used for hunting elk. SSN has communicated that prior to 1846, *Pípsell* was the site of ceremonial practices, hunting, trapping, fishing, camping, and gathering berries and other food plants. SSN has also communicated that medicinal plants collected in this area were valued and unique due to the presence of copper in the underlying soils. The Jacko Lake in- and out-flows were also the site of an important traditional spring trout fishery. In spring, roots and fish from *Pípsell* were of critical importance to SSN's seasonal round as higher elevation plants were not yet available. *Pípsell* also includes evidence of historical trails and travel ways, including a trail connecting Kamloops Lake and Lac le Jeune.

SSN is of the view that although previous activities have left the lands and waters in *Pípsell* impacted, the area remains sufficiently intact to support SSN's traditional activities. SSN communicated that members have continued to practice traditional activities at *Pípsell* and that members can recall hunting, fishing, and picking berries, other food plants, and medicinal plants at *Pípsell*. SSN also communicated that members have shared stories of members harvesting deer at the site when the previous mine was operating. In recent years, with the cooperation of KAM to enable access to the private land on which Ajax is proposed, there has been a resurgence of cultural practices at *Pípsell,* including the re-establishment of a historical sweat lodge, the ongoing construction of a second sweat lodge, exercise of ceremonial practices, and increased hunting, fishing, and educational programs for SSN children and youth. SSN reports that members continue to trap in the area and that in 2017, SSN purchased a trap line adjacent to the mine site. There are no registered trap lines on the mine site and KAM has no record of onsite trapping since they have owned the site.

SSN communicated that although traditional activities have continued at *Pipsell* and elsewhere in SSN's asserted traditional territory, they have been limited since the 1860s by the privatization of lands, which included SSN member Phillip Jacko being forced out of the Jacko Lake area despite his efforts to exercise control. Other limiting factors have included mining activity, ranching, development of road and energy infrastructure, the establishment and growth of the City of Kamloops, residential schools, and a reduction in the SSN population due to the introduction of new diseases. SSN has communicated that due to the spiritual and cultural importance of *Pipsell*, traditional activities conducted there cannot be conducted in the same manner elsewhere in their asserted traditional territory, and that any effects resulting from Ajax would exacerbate the effects on traditional activities that are being experienced at a regional scale.

On June 21, 2015, SSN sent a letter to the federal and provincial governments asserting title to *Pipsell*. SSN filed a claim in the British Columbia Supreme Court on September 21, 2015, seeking a declaration of Aboriginal rights and title to a territory identified in the claim, stretching southeast of McBride along the Alberta border to Invermere, southwest toward Trail, and northwest toward the Taseko Lakes. The claimed area includes the private and publicly owned lands that comprise the site of the proposed mine and the associated subsurface rights.

24.2 SUMMARY OF CONSULTATION ACTIVITIES

The following section describes the actions undertaken by the Agency and EAO in order to fulfill the Crown's duty to consult deeply with SSN.

24.2.1 CONSULTATION BY THE AGENCY

24.2.1.1 *Consultation Approach Development and Implementation*

The Agency began consulting Tk'emlúps te Secwépemc (Tk'emlúps Indian Band) and Skeetchestn Indian Band at the start of the EA. On July 7, 2011 the Agency sent Skeetchestn Indian Band and Tk'emlúps te Secwépemc a letter informing them of the Agency's preliminary understanding of potential impacts to both groups' asserted Aboriginal rights and the accompanying determination that both Skeetchestn Indian Band and Tk'emlúps te Secwépemc were owed consultation at the deep end of the *Haida* consultation spectrum. At that time, the Agency also proposed a draft consultation approach consistent with a high depth of consultation.

In July 2011, the Agency shared Consultation Approaches with each Indigenous group that set out proposed activities to engage Indigenous groups in the EA process and to assist the federal Crown in fulfilling its consultation obligations.

The Agency has worked with both groups through SSN to respond to their concerns regarding consultation and to find ways of creating a more meaningful consultation process. In response to multiple discussions and written feedback, the Agency combined the two group-specific approaches into one overall Joint Consultation Approach with SSN and made substantial changes to the format, activities, and overall content of the document. These changes, discussed most recently with SSN in September 2016, included the addition of SSN's consultation objectives, increased opportunities for SSN's participation in the EA process, identifying points of intersection between the federal EA and SSN's own assessment process, and making commitments to share the outcome of SSN's assessment process with the federal decision-maker.

The Agency has engaged SSN throughout the EA. SSN reviewed and commented on key documents, including the EISG/AIR, the EIS/Application and corresponding reports, federal information requests to KAM, and a draft version of this Report. Additional information was received from SSN through the working group, technical meetings, bilateral and trilateral nation-to-nation meetings, correspondence, and through information sessions in SSN communities.

24.2.1.2 *Federal Participant Funding Program*

The Agency supports Indigenous participation through its Participant Funding Program by providing funds to reimburse eligible expenses of groups that participated in the EA. Tk'emlúps te Secwépemc and the Skeetchestn Indian Band applied for funding and collectively received $249,050 through this program.

24.2.2 CONSULTATION BY THE PROVINCE

The EAO began consulting Tk'emlúps te Secwépemc (Tk'emlúps Indian Band) and Skeetchestn Indian Band at the start of the EA. On February 25, 2011, the EAO sent Skeetchestn Indian Band and Tk'emlúps te Secwépemc letters informing them of the Ajax EA and describing the EAO's intention to consult with each Indigenous group. In letters dated September 20, 2011, the EAO provided initial assessments of the strength of Tk'emlúps te Secwepemc's and Skeetchestn Indian Band's claimed Aboriginal Interests in the vicinity of Ajax. The letters concluded that the Province had a duty to consult with SSN regarding the EA for Ajax at a level consistent with the deep end of the *Haida* spectrum. In a letter dated November 7, 2012, the EAO shared a preliminary strength of claim assessment finding that SSN had a strong *prima facie* case to support Aboriginal rights and a weak to moderate *prima facie* case for Aboriginal title. Thus, the EAO continued to consult in a manner consistent with the deep end of the *Haida* spectrum. On May 12, 2015, following the Supreme Court of Canada's *Tsilhqot'in Nation v. British Columbia* decision, the EAO provided SSN with a revised preliminary assessment stating that SSN has a strong *prima facie* claim of Aboriginal title to the proposed site of Ajax. The EAO's previous assessment that there is a strong *prima facie* claim to Aboriginal rights to hunting, fishing, trapping, gathering, and spiritual use by SSN in the areas in proximity to the project area remained unchanged. Based on these assessments of *prima facie* strength of claim, the EAO continued to consult at the deep end of the *Haida* spectrum.

This section describes consultation from the start of the EA, and includes an overview of how information provided through the SSN Assessment Process was considered in the EA. The section also describes the procedural aspects of consultation undertaken by KAM at the EAO's direction on behalf of the Crown and an overview of SSN's views of the consultation process.

24.2.2.1 *Pre-EIS/Application and EA Collaboration Plan Development*

The following section contains an overview of key opportunities for SSN input during the pre-EIS/Application stage of the EA, from initiation through development of the EISG/AIR, until KAM submitted the EIS/Application to the EAO for evaluation/screening. It also describes the purpose and the development of the EA Collaboration Plan between the EAO and SSN.

The pre-EIS/Application phase of the EA commenced in February 2011, when the EAO issued a section 10 order and separately notified Tk'emlúps te Secwépemc and Skeetchestn Indian Band. On January 11, 2012, the EAO issued a section 11 order that set out the scope of the EA including the basis of consultation.

Following the issuance of the section 10 order, SSN and the EAO met nine times and had multiple telephone conferences to discuss the EA process and the potential impacts of Ajax on SSN's Aboriginal Interests. During pre-EIS/Application, the EAO held four technical working group meetings and four topic-specific technical working group meetings. SSN was represented at all of these meetings. During pre-EIS/Application, SSN also participated in working group conference calls regarding the EA process. The EAO also specifically invited SSN to comment on:

- Proposed working group meeting agendas and working group meeting summary notes;
- Draft legal documents, the section 11 order (January 11, 2012); and
- Key project documents, including from KAM's original and revised Project Descriptions and the draft EISG/AIR (issued June 2013).

Based on SSN's comments on the draft EISG/AIR, the Agency and EAO required KAM to make numerous changes including requirements for additional baseline information on cultural resources, consideration of effects on culturally important resources, assessment of health and well-being, and consideration of approaches to water management, prior to the Agency and EAO issuing the document on June 3, 2013.

Following KAM's announcement of planned changes to Ajax's general arrangement in May 2014, the Agency and EAO required KAM to update the EISG/AIR to reflect any material changes to the project components and/or necessary study information. The Agency and EAO consulted SSN regarding the proposed updates and provided an additional opportunity for SSN to comment on the draft EISG/AIR in its entirety. In direct response to issues raised by SSN, and to ensure that the EIS/Application provided adequate information to understand the potential impacts of Ajax on SSN's Aboriginal Interests, the revised EISG/AIR that was issued on July 25, 2015 included the following changes:

- Addition of a valued component titled "Current Use of Land and Resources for Traditional Purposes" that includes consideration of the importance of *Pípsell*, the interconnectedness between the various components of *Pípsell*, SSN's seasonal rounds, and the pathways of effects between Ajax and SSN's use of and access to these areas;
- Inclusion of Aboriginal rights and title as an information requirement in Part C; and
- Inclusion in Part C of additional information requirements regarding a description of governance structures of Indigenous groups, including SSN.

On August 7, 2015, the EAO provided further direction to KAM instructing them to submit an addendum submission by day 60 of the review phase. This letter required that the addendum submission include the following:

- An assessment of a newly added SSN Aboriginal Economies valued component as requested by SSN; and
- Further information on SSN governance (*X7ensq't*) as outlined by SSN in their July 10, 2015 proposal.

The letter also encouraged KAM to include any additional information relating to impacts to Aboriginal rights and current use of lands and resources for traditional purposes that was obtained through the course of producing the addendum.

From mid-2015 through to the end of the pre-EIS/Application phase in early 2016, the EAO's consultation approach was further enhanced through discussion with SSN. Notably, following the EAO's notification to SSN that the Province had revised its preliminary assessment to a strong *prima facie* claim of Aboriginal title within the project area by SSN, and SSN's requests to have a coordinated provincial approach to all Ajax-related consultation, the Province expanded its consultation approach to include the EA, permitting processes, and government to government negotiations of accommodations. The Province initiated an Ajax Government to Government discussion table in mid-2015 that included SSN, the EAO, MMPO (MEMPR), Ministry of Indigenous Relations and Reconciliation (MIRR), MFLNR, and other provincial agencies as necessary. This expanded consultation included the collaborative development of an over-arching Government to Government Framework Agreement (Government to Government Framework) to further the relationship between SSN and the Province (led by MMPO) as it relates to Ajax.

In May 2015, the EAO and SSN agreed to create the EA Collaboration Plan in conjunction with the development of the Government to Government Framework. After the initiation of the Ajax government to government discussions and development of the EA Collaboration Plan, SSN announced that they would also be undertaking their own community-based SSN Assessment Process (see section 24.3 and the SSN Decision Package). The draft EA Collaboration Plan was subsequently adapted to identify key collaboration points that would embed the SSN Assessment Process in the provincial EA for Ajax. The EA Collaboration Plan was largely completed by February 2016 and applied to the EA from that point on, in advance of the formal signing of the plan and the Ajax Government to Government Framework Agreement in September 2016.

The stated purposes in the final EA Collaboration Plan are to embed SSN's Assessment Process into the provincial EA process, to support informed decision making, to ensure that SSN had direct input into the provincial decision-making process, and to ensure that SSN's input was adequately considered in the EA. The plan also identifies key collaboration points in the EA at which SSN and the EAO committed to sharing specific pieces of information and/or undertaking specific collaborative activities and includes opportunities for SSN and the EAO to jointly assess the efficacy of implementation and establishes an approach to issues management and resolution.

On April 28, 2016, in response to requests from SSN, the EAO issued a section 13 order to officially recognize the EA Collaboration Plan and to add greater specificity to the consultation activities the EAO would undertake with SSN during the remaining stages of the EA.

24.2.2.2 *EIS/Application Screening/Evaluation Period and Early EA Collaboration Plan Implementation*

During screening/evaluation of the EIS/Application, the EAO invited SSN and other members of the working group to provide comments on the adequacy of the EIS/Application relative to the EISG/AIR. The screening/evaluation of the EIS/Application commenced in September 2015 and was concluded on November 20, 2015. During this time, the EAO extended the 30-day regulatory timeline by 38 days to accommodate both SSN and a request from KAM. Although accepted in November 2015, the EIS/Application was not filed with the EAO until January 18, 2016.

Although the EA Collaboration Plan was still in development during the EIS/Application screening phase, the EAO and SSN had begun implementing collaboration steps. For example:

- In consideration of the screening timeline extension and to support SSN's participation in the screening/evaluation of the EIS/Application, the EAO and SSN developed and implemented a schedule that provided additional time for SSN and their technical experts to provide comments, and for KAM to respond. The schedule also provided an opportunity for the EAO and SSN to meet to discuss any outstanding concerns and for the EAO to provide written rationale in relation to any outstanding comments or concerns of SSN regarding the EIS/Application screening; and

- Prior to formal submission of the EIS/Application in January 2016, the EAO and SSN met and exchanged information to ensure a common understanding of the scope of SSN's Aboriginal Interests and how the impacts of Ajax to SSN's Aboriginal Interests would be assessed by each party.

During screening, the EAO also invited SSN to comment on KAM's pre-EIS/Application consultation activities and consultation activities proposed for the review phase (including review of KAM's First Nations Consultation Report dated July 2015, KAM's First Nation Consultation Plan dated July 2015 and the EAO's preliminary assessment of KAM's consultation). Following written and face-to-face feedback from SSN, the EAO provided direction to KAM on November 20, 2015. This direction required KAM to prepare an updated First Nations Consultation Plan for review prior to submission of the EIS/Application, and based on this revised plan, to submit a draft First Nations Consultation Report for review by SSN by day 90 of the review phase.

24.2.2.3 *EIS/Application Review*

The EA Collaboration Plan guided the EAO's consultation with SSN throughout the review phase. As set out in the Collaboration Plan, the EAO and SSN undertook the following activities:

- Collaborative development and implementation of a detailed schedule to support SSN and the EAO in aligning their respective processes and fulfilling commitments made in the EA Collaboration Plan;
- Scheduled weekly or bi-weekly government to government meetings with SSN and other provincial agencies (in person, by telephone, or videoconferencing) to support the development and implementation of the Government to Government Agreement and the Collaboration Plans, and to address ongoing concerns and interests of SSN related to Ajax. Meetings were held from August 2015 through the duration of the EA;
- The EAO met with SSN on October 20, 2016 to provide an overview of the EAO's policy and guidance on EA Certificates and condition development. The EAO offered to also meet with the SSN Review Panel that was conducting the SSN's Assessment Process to discuss EA Certificates and condition development. These offers were not accepted; and
- SSN and MMPO maintained the provincial SSN Tracking Table to ensure a comprehensive and accountable record of issues and responses raised regarding Ajax, including EA issues, permitting issues, and issues relating to accommodation discussions with the Province. In regard to the EA, the table is broad-ranging and includes technical comments regarding Ajax, SSN's concerns regarding the potential impacts of Ajax on SSN's Aboriginal Interests, SSN's concerns regarding consultation with the EAO and KAM, and responses from the appropriate party.

During this phase of the EA, SSN continued to participate in working group activities, including all working group meetings, nine technical sub-working group meetings on specific topics, and several topic-specific teleconferences to address key EA issues.

During EIS/Application review, SSN provided comments on the EIS/Application and the Day-60 Addendum submissions. These comments included technical comments and comments regarding the potential impacts of Ajax on SSN's Aboriginal Interests. Following KAM's response to these comments, the EAO and SSN discussed the adequacy of KAM's responses. The EAO and SSN also worked together to identify where additional information was required from KAM. As part of their Assessment Process, SSN held a five-day community Review Panel oral proceeding in early May 2016. The EAO was invited to observe the first four days, to listen and learn from the stories and information that were shared. At SSN's request, on day five the EAO presented information regarding the EA process, and a representative of MMPO presented preliminary information regarding the government to government negotiations. Following the proceedings, SSN provided the EAO and KAM with the reports from their technical experts and a list of questions from panel members. The EAO directed KAM to track and respond to the EIS/Application-related questions in the provincial SSN Tracking Table. Where appropriate, the EAO and MMPO also responded.

On March 4, 2016, while the EA for Ajax was ongoing, SSN Joint Council concluded the SSN Assessment Process and announced that SSN does not give free, prior and informed consent to the development of Ajax. This decision was supported by the materials included in the SSN Decision Package.[72] As per the EA Collaboration Agreement and previous SSN-EAO discussions and correspondences regarding methodologies, the EAO has incorporated information from the SSN Decision Package into this Report and responded to key issues. The SSN Decision Package will also be included with the materials given to the ministers to support their decision regarding Ajax. In addition to the activities set out in the EA Collaboration Plan and described above, SSN and the EAO engagement activities included the following:

- Frequent written exchanges by email and letter;
- Regular staff level meetings and calls as needed including scheduling a bi-weekly call from September 2016 throughout the remainder of EIS/Application review;
- Representatives of the EAO attended two SSN community information sessions during the SSN's Assessment Process (April 4 and 5, 2016); and
- Representatives of the Agency and EAO presented draft joint Report results to the SSN community panel and responded to questions (June 27, 2017).

To prepare this Report, the EAO considered all comments and information received from SSN, including (but not limited to):

- Letters and emails;
- Comments and submissions shared through working group processes (e.g., EIS/Application evaluation/screening, EIS/Application review, working group meetings);
- Information shared at face-to-face meetings and telephone calls;
- The SSN Cultural Heritage Study (2014);

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[72] SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax; SSN (2017) SSN Panel Recommendations Report for the proposed KGHM Ajax Project at Pípsell; SSN (2017) Pípsell Decision Summary Booklet

- The SSN Preliminary Mitigation Report (2014);
- Five SSN 360 Reports for the KGHM Ajax Project at *Pípsell*; and
- Information generated through the SSN Assessment Process (e.g., process planning information sheets, SSN *Pípsell* Impacts and Infringements Report, post-Panel *Pípsell* Supplementary Reports, SSN Decision Package).

As described above, issues, comments, and concerns were forwarded to KAM and tracked in the provincial SSN Tracking Table. As appropriate, the EAO, MMPO, and KAM responded directly in the table or in topic-specific memos that are referenced in the table. The EAO worked with SSN to review the adequacy of KAM's responses and, where appropriate, required KAM to update the provincial SSN Tracking Table. The EAO also considered KAM's responses in the development of this Report.

24.2.2.4 *Provincial Capacity Funding*

The EAO provides funding to Indigenous groups to assist with costs associated with their participation in the pre-EIS/Application or EIS/Application review phase of the EA. During the pre-EIS/Application phase of the EA, the EAO provided $5,000 of capacity funding each to Tk'emlúps te Secwépemc and Skeetchestn Indian Band ($10,000 total). To assist with the costs associated with EIS/Application review, the EAO provided SSN with $40,000 of capacity funding. Although this amount represented double the customary amount of EIS/Application review phase funding, the EAO acknowledges SSN's views, expressed in a letter dated November 2, 2015, that this amount is insufficient to meaningfully participate in the EA.

For Ajax, additional funding was provided by the Province of British Columbia, through MIRR, to support the increased collaboration activities. In 2016, SSN received $150,000 from the Province to support development of the Ajax Government to Government Framework and the development of the EA Collaboration Plan and an Ajax Mine Permitting Collaboration Plans. In November 2016, SSN communicated that additional funding would be required in order for them to restart their assessment process, which had been extended since May 2016. In February 2017, the Province provided an additional $50,000 to support SSN's ongoing participation in the EA, provision of the completed *Pipsell* Impacts and Infringements Report to the Province, continued development of the Ajax Mine Permitting Collaboration Plan, and participation in any interim permitting work plans.

24.2.2.5 *Provincial Accommodation*

On February 15, 2017, the Province of British Columbia tabled an accommodation offer to SSN that consists of measures to be provided by BC to SSN to address potential residual effects from Ajax, should Ajax be approved and become operational. The accommodation offer was aimed at addressing complex and diverse community concerns that were raised during consultation activities on Ajax to date, at the time of the offer, including concerns with regards to impacts on SSN's asserted rights and title. The accommodation offer was intended to help increase certainty and predictability in relation to Ajax.

Socio-Cultural

The Province proposed to work with SSN to develop initiatives to address potential residual effects of Ajax related to language and culture, health, family and community development, education, and employment and training. The Province proposed to provide a financial contribution of $2 million to SSN to be provided in installments over 4 years under the terms of an agreement, to increase SSN's capacity to participate in a socio-cultural working group with the Province. The purpose of that group would be to identify existing and new opportunities and initiatives to support priority socio-cultural needs of the community.

Economic

The Province proposed to explore ways to address interests related to economic development, including through a transfer to SSN of Crown land(s) with a value of up to $8 million and through resource revenue sharing of 37.5% of the *Mineral Tax Act* revenues collected by the Province on Ajax, in accordance with the terms of an Economic Community Development Agreement.

Water and Lands Stewardship

The Province proposed to undertake a pilot collaborative stewardship initiative with SSN in the Thompson River watershed. Such an initiative could include addressing ecosystem health and environmental risks through research, monitoring or other initiatives. To support the work of stewardship initiatives, the Province would provide $100,000 in funding for the first year under the terms of an agreement. It is anticipated that multiple year funding will be pursued by other water users and pilot participants, including KAM. Additionally, the Province proposed to explore opportunities for collaboration with SSN for enhanced management and the conservation of sensitive areas.

No accommodation agreements have been signed at the time of this Report and SSN has communicated that the accommodations proposed by the Province are "not sufficient to justify the many impacts and risks associated with the proposed Project".[73]

24.2.3 CONSULTATION BY KAM

24.2.3.1 *KAM Consultation Activities*

KAM's First Nations Consultation Report (April 13, 2017) states that they began consulting with SSN regarding Ajax in 2008.[74] Early consultation activities included introductory meetings, funding for archaeological studies and legal assistance (July 2008), site visits (August 2009), and a written advanced exploration agreement (December 2010).

During EAs, the EAO delegates some procedural aspects of consultation to proponents, namely the responsibility for sharing information with Indigenous groups about the effects of a project on Aboriginal Interests, and gathering and responding to concerns and ideas raised about measures to reduce project related impacts on Aboriginal Interests. The following provides a summary of KAM's consultation activities from the issuance of the section 11 order until the end of EIS/Application review. A more detailed description of KAM's consultation with

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[73] SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax, p. 71

[74] https://projects.eao.gov.bc.ca/p/ajax-mine/docs?folder=1

SSN is provided in section 15 of the EIS/Application and in KAM's Day-120 First Nations Consultation Report (April 13, 2017).

The section 11 order required KAM to seek input from SSN on the appropriate means of consultation and to incorporate this input into a First Nations consultation plan. The EAO also required KAM to produce summary reports for the pre-EIS/Application and the EIS/Application review phases, describing their consultation activities undertaken with SSN. KAM was also required to provide SSN with opportunities to review drafts of consultation reports. The first of these reports was received in July 2015, and an updated version was submitted as part of KAM's EIS/Application (Chapter 15)[75] and the second was received on April 13, 2017. KAM's plan and reports enabled the EAO to:

- Understand KAM's consultation plans and subsequent efforts, and the perspectives of SSN related to those efforts;
- Evaluate KAM's intended consultation activities with SSN during EIS/Application review phase; and
- Understand issues and concerns identified by SSN.

Under the terms of a Study Funding Agreement (December 2012), KAM provided SSN with funding to conduct a historical and contemporary traditional knowledge/traditional land use study in the vicinity of Ajax. In November 2014, SSN shared the SSN Cultural Heritage Study – Final Report[76] that describes Secwépemc traditional use and occupancy of the area involving and surrounding Ajax. In June 2014, SSN also produced a Preliminary Mitigations Report[77] that provided a framework within which SSN proposed consideration of potential impacts on its cultural heritage. SSN describes the geographic scope of these documents as being limited to the original general arrangement proposed for Ajax.

KAM's First Nations Consultation Report states KAM's view that the Cultural Heritage Study agreement was for a larger area that should have included the footprint of the revised Ajax general arrangement. SSN requested, and KAM provided, additional capacity funding to SSN in October 2014 to enable SSN to conduct additional cultural and heritage study work and provide a report (Cultural Heritage Study Phase Two). In this funding agreement, the work was to be completed by February 2015. In September 2015, KAM provided further funding to complete the Phase 2 Cultural Heritage Study. The results of this additional work by SSN are still pending at the time of writing.

KAM's First Nations Consultation Report states that, in advance of submitting their EIS/Application to the EAO, KAM provided SSN with draft copies of the EIS/Application sections pertaining to Aboriginal Interests and consultation to receive comments, feedback, and input and to verify KAM's understanding.

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[75] https://projects.eao.gov.bc.ca/p/ajax-mine/docs?folder=1

[76] Ignace, M. (2014) SSN Cultural Heritage Study – Final Report

[77] SSN (2014) Preliminary Mitigations Report

During the EIS/Application review phase, KAM participated in the SSN Assessment Process by making presentations to the SSN Review Panel (May 2016). KAM fielded questions from the Review Panel on the results of KAM's effects assessment. KAM also presented to the SSN Review Panel regarding the proposed KAM/SSN mine development agreement/accommodation package. Following direction from the EAO after the SSN Review Panel oral proceedings, KAM also responded to comments and questions submitted to the EAO in May/June 2016.

According to KAM's Day 120 First Nations Consultation Report, additional KAM-led consultation activities included:

- Regular capacity and project agreement meetings;
- Regular technical meetings;
- Providing project notification;
- Participating in regular Chief to Chief Meetings;
- Meeting with leadership, staff, consultants and membership;
- Participating in project meetings;
- Participating in SSN Community Meetings, including presentations and responding to questions;
- Sharing of project related information, including focused presentations on topics of interests and/or concern to SSN, and early drafts of EA documents;
- Providing site tours to SSN;
- Facilitating SSN's access to the site for ceremonial and cultural purposes including hunting, fishing, ceremonies, and sweat lodges;
- Discussing potential adverse impacts on Aboriginal Interests, and measures to avoid, mitigate, or otherwise accommodate, as appropriate, any adverse effects;
- Responding and following up with SSN regarding the identification and resolution of issues;
- Notifying SSN of submission of the EIS/Application and providing copies of the EIS/Application; and
- Conducting meetings to support review of the EIS/Application, addressing issues and concerns, refining mitigation measures, discussing project related benefits and opportunities (economic and non-economic), identifying and planning follow-up strategies, and ensuring additional consultation and engagement requirements or commitments in relation to Ajax's approval and construction are undertaken.

KAM has also informed the EAO that they continue to work closely with SSN to identify economic, contracting, employment, and training opportunities.

24.2.3.2 *KAM Funding and Agreements*

KAM provided capacity funding, specifically for SSN's participation in the EA, from 2015 to 2017. KAM's First Nations Consultation Report identifies a range of funding that KAM provided to SSN to facilitate participation in the EA process and to support an understanding of SSN's Aboriginal Interests. According to KAM, they entered into a number of agreements with SSN between 2008 and 2016, providing a total value of over $3.8 million to facilitate, among other things, the development of the Cultural Heritage Study (phases one and two), SSN's participation in the EA process, and completion of the SSN Assessment Process.

24.2.4 SSN'S KEY CONCERNS REGARDING CONSULTATION

Throughout the EA, SSN raised concerns regarding the federal and provincial consultation processes. The Agency and EAO understand SSN's key concerns to be:

- The capacity challenges associated with multiple consultation processes related to Ajax, including the EA, permitting, and government to government discussions;
- The concurrent development of the consultation processes (both federal and provincial) while conducting the EA and the strain this placed on SSN's capacity;
- The timelines associated with the EA limit SSN's ability to participate in the EA;
- Inadequate capacity funding from the Crown to allow for SSN's full participation in the EA and consultation process;
- The Agency and EAO's decision to develop this Report jointly;
- The EA process is not an appropriate process to use for consulting on and assessing impacts to SSN's Aboriginal rights because it does not take a holistic approach, nor does the process capture the interconnectedness of the environment, Aboriginal rights, and impacts of Ajax to the satisfaction of SSN; and
- The federal and provincial EA and consultation processes do not constitute meaningful consultation, particularly in relation to the United Nations Declaration on the Rights of Indigenous Peoples.

In addition to addressing these concerns in this Report, the Agency tracked and responded to SSN's concerns in the federal Issues Tracking Table, which was shared with SSN. The EAO documented and responded to SSN's concerns in the Provincial SSN Tracking Table and through correspondences (available at https://projects.eao.gov.bc.ca/p/ajax-mine/docs?folder=1]).

24.3 SSN ASSESSMENT PROCESS

In July 2015, SSN Joint Council decided to undertake their own assessment process with the purposes of assessing impacts of Ajax in a way that respects SSN knowledge and perspectives and of facilitating informed decision-making by their communities in a manner that is consistent with SSN laws, governance, traditions, and customs. The sections below describe the Agency and EAO's understanding of the SSN Assessment Process, as it has been communicated to the Agency and EAO by SSN. SSN's Decision Package provides a full description in their voice.

SSN has described that their Assessment Process respected the concept of "Walking on Two Legs", or the consideration of both SSN cultural and traditional knowledge and western science. The Process employed a framework developed from the Trout Children *Stseptékwll*, and was designed to examine Ajax in an interconnected and holistic way that SSN distinguishes from the provincial and federal approaches, which SSN states were inadequate to fully and properly assess the impacts on *Pípsell* and on SSN.

To support SSN's decision-making, SSN established a community Review Panel in late 2015, composed of 46 SSN members who represent the families of Tk'emlúps te Secwépemc and Skeetchestn Indian Band. SSN Joint Council asked the Review Panel to consider the following question:

> *In recognition of the Declaration of Title to Pípsell (Jacko Lake & its surroundings), a cultural keystone area with significant spiritual and historical importance to the Stk'emlupsemc te Secwépemc Nation,*

> *does the Stk'emlupsemc te Secwépemc Nation give their free, prior and informed consent to change the land use objective to allow for development of the lands and resources for the purposes of Ajax in accordance with the Stk'emlupsemc te Secwépemc Nation's laws, traditions, customs and land tenure systems supported by the SSN five assessments: Indigenomics, Health and Wellness, Timcw, Integrity and Respect?"*[78]

The Review Panel convened for oral proceedings from May 2, 2016, to May 6, 2016, to consider information presented by SSN knowledge keepers, SSN technical consultants, KAM and their technical consultants, and representatives from the federal and provincial governments, including EAO, MFLNR, MMPO, and MEMPR. Representatives from the federal government, including the Agency, DFO, NRCan, HC, and ECCC, attended as observers, with the Agency also providing information on the federal EA process. Following the oral proceedings, panel members continued to meet semi-regularly to receive additional information and updates on the status of Ajax. On March 4, 2017, while the EA for Ajax was ongoing, SSN Joint Council adopted the recommendations of their Review Panel and announced that SSN does not give free, prior and informed consent to the development of Ajax. The decision materials resulting from SSN's Assessment Process will be included in the materials provided to ministers to support their decisions. [79]

24.4 SSN CONCERNS AND ABORIGINAL INTERESTS POTENTIALLY IMPACTED BY AJAX

The Agency and EAO have structured this section to reflect the information and identified Aboriginal Interests presented in the SSN Decision Package and supporting materials provided by SSN. Each of the sections includes a summary of the Agency and EAO's understanding of the following:

- SSN's identified Aboriginal Interests, as described in the SSN Decision Package and other materials provided by SSN during the EA; and
- Potential impacts and SSN's conclusions as described in the SSN Decision Package.

Where appropriate, a discussion of key issues that SSN raised during the EA and relevant technical information from the EA is also included, as are KAM's proposed mitigations, EAO's proposed EA Certificate conditions, and other accommodations offered by the Province.

In Key Considerations (section 24.4.1), the Agency and EAO have summarized SSN's views and concerns related to *xqelmecwétke*: water world and water people, sky world and grandfather sky, holistic health, intergenerational teachings and knowledge transfer, and indigenomics. Each of these sections also describes how the related information was considered in the assessment of seriousness of impacts on SSN Aboriginal Interests.

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[78] SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax, p. 7

[79] SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax; SSN (2017) SSN Panel Recommendations Report for the proposed KGHM Ajax Project at Pipsell; SSN (2017) Pipsell Decision Summary Booklet

In the Assessment of Seriousness of Impacts to SSN Interests and Concerns (section 24.4.2), the Agency and EAO have summarized SSN's views and concerns and conducted an analysis of the seriousness of impacts to SSN's fishing activities, plant gathering activities, hunting and trapping activities, use of metals, spiritual and cultural practices, and asserted Aboriginal title.

24.4.1 KEY CONSIDERATIONS

24.4.1.1 *Xqelmecwétke: Water World and Water People*

In reports produced by SSN during their own assessment process, SSN communicated the importance of water in general and of the water at *Pípsell* specifically.[80] As described by SSN, water has inherent spiritual, medicinal and cultural values for Secwépemc people and is integral to their intergenerational sustainability and health.

During the EA, SSN communicated that the waters of *Pipselletkwe* (*Pípsell,* including Jacko Lake) are unique. SSN described how *Pípsell* includes the waters that anchor the Trout Children *Stseptékwll* to the land. According to SSN, the Trout Children *Stseptékwll* and other SSN oral histories tell of *xqelemcwétke* (water beings or trout people) that live at the bottom of Jacko Lake. According to these oral histories, the *xqelemcwétke* are regarded as family of SSN and the water worlds of *Secwepemcúlecw* are connected by way of aquifers.

The information provided by SSN explained that prior to European contact, water was used for healing and that SSN members continue to use water as a medicine through ceremonial activities, such as sweats, and that sweat lodges are always built near water.

According to SSN, their asserted water use rights require the exercise of traditional and cultural practices involving water and the water spirits as directed by the Old One (e.g. *sq'ilye*) and the recognition of Secwépemc law as it relates to water (e.g. Trout Children *Stseptékwll*). SSN communicated that under Secwépemc law, the management, preservation, and restoration of the *Pípsell* water world and *xqelemcwétke* is the responsibility of SSN. This relationship of reciprocal accountability and moral obligation to the animate beings on the land is expressed through the term *xwexwéyt re k'wséseltkten*, or all my relations. Relatedly, SSN also asserted a right to sustainable watersheds.

SSN's final conclusion related to *xqelemcwétke*: Water World and Water People is that water is integral to their way of life, and to the survival of all relations in *Secwepemcúl'ecw*. *Pipselletkwe* is a place that is significant to SSN in many ways and the potential loss of this area is not a risk that they are willing to take. SSN states that Ajax represents an unacceptable risk of irreparable harm to the Water World and Water Beings.

In the SSN Decision Package, SSN states that they are of the view that Ajax would have "significant adverse effects on the Water World, including the loss of the power of the place and a loss of a connection to the water people who live in or under the lake" and that Ajax would have "adverse impacts on the water quality and quantity in the waterways in our Territory which violates our obligation to the Water World"[81].

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[80] SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax; SSN (2017) SSN Panel Recommendations Report for the proposed KGHM Ajax Project at Pípsell; SSN (2017) Pípsell Decision Summary Booklet

During the EA, SSN identified a number of concerns related to the effects of Ajax on ground and surface water and regarding the long term impacts and fundamental changes to the water systems in *Pípsell*. The Agency and EAO understand SSN's key concerns to be:

- Effects to surface water bodies outside of the mine footprint, including Edith Lake;
- Effects of mine runoff and seepage to surface and ground water quality;
- Risk of Jacko Lake waters seeping or draining into the open pit and a lack of consideration of SSN traditional knowledge describing an underground water conduit between the two;
- KAM's preliminary water quality and water quantity data are insufficient and that the proposed mitigation and monitoring measures are inadequate;
- The risk that the Edith Lake fault zone could act as a conduit for contaminated water from the tailings storage facility to the waters of *Pípsell*;
- Effects of climate change when assessing potential mine effects to water;
- Effects of Ajax's water use on Kamloops Lake and the Thompson River including:
  - The cumulative effects of their proposed water use quantities,
  - The combined effects of water use and climate change, and
  - The potential use of treated effluent as an alternative to withdrawing water from Kamloops Lake; and
- Concern that changes to surface water flow in Peterson Creek have only been assessed for licenced water users and have not been assessed in terms of any potential thresholds or minimum flows.

Technical issues raised by SSN during the EA were considered in the Agency and EAO's review of the EIS/Application. Details of the Agency and EAO's assessment of the effects to surface water and ground water, including conclusions regarding the significance of potential effects and a description of legally binding EA Certificate conditions proposed by EAO, can be found Part B of this Report. The following section provides a summary as it relates to the concerns raised by SSN.

As described in Surface Water Quality and Quantity (section 2), the Agency and EAO expect that effects of Ajax to surface water would be limited to the Peterson Creek watershed and would not include Edith Lake. The Agency and EAO note that there would be no surface discharge from Ajax to the receiving environment and that dustfall-related effects on surface water quality would be limited. The Agency and EAO do not anticipate that Ajax would result in residual adverse effects to water quality in Jacko Lake.

The Agency and EAO are of the view that the likelihood of a significant volume of water transferring from Jacko Lake into the open pit is very low, although the effects of such an incident would be catastrophic to Jacko Lake and lower Peterson Creek. KAM has proposed a series of preventative controls, responses and monitoring plans to mitigate the risk, including pit wall depressurization and continuous monitoring of slope stability and buttressing.

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[81] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pipsell, p. 71

The Agency and EAO are of the view that the risk of the Edith Lake fault zone causing adverse effects on water quality in Jacko Lake is very low. The EAO has proposed an EA Certificate condition requiring KAM to develop and implement a groundwater investigation plan that would reduce uncertainties related to the groundwater flow regime at Ajax, including the influence of the Edith Lake fault zone and Jacko Lake, prior to construction. The EAO also understands that additional mitigation and management measures would be required as conditions of the *Mines Act* permit.

Ajax would result in reduced stream flows in upper and lower Peterson Creek and reduced inflows to Jacko Lake. The Agency and EAO conclude that, with implementation of mitigation measures and proposed EA Certificate conditions that include the development and implementation of a long-term streamflow management strategy, Ajax would be able to maintain near baseline streamflow levels and there would be no significant adverse effects to surface water quantity. For groundwater, the Agency and EAO conclude that changes to the groundwater balance would be permanent and spatially limited to up to 2 km from project facilities and that the effects would not be significant. The Agency and EAO expect that uncertainties in existing baseline groundwater conditions can be addressed through additional studies prior to construction and that potential residual effects would be managed through monitoring and adaptive management.

To mitigate and manage potential effects to groundwater quantity, the EAO has proposed EA Certificate conditions that would require KAM to develop and implement surface water and groundwater management and monitoring plans that would be required to reflect updated groundwater models. The conditions would require that these plans be developed in consultation with SSN.

In response to SSN's concerns regarding potential effects and further assessment of the sensitivity of the Thompson River system to stressors, including climate change, KAM wrote to the Province in March 2016 requesting that the provincial government consider initiating a water stewardship study over the Kamloops Lake watershed, and expressed an interest in supporting this initiative should it proceed. In materials presented to SSN on February 15, 2017, the Province proposed accommodation to SSN to undertake a pilot collaborative stewardship initiative with SSN in the Thompson River watershed. Additional detail can be found in section 24.2.2 of this Report. No accommodation agreements have been signed at the time of this Report, and in the SSN Decision Package, SSN Joint Council rejected the accommodation proposed by the Province.[82]

SSN's concerns regarding the potential impacts of Ajax to the spiritual and cultural values associated with water, water world and water people, including the potential effects of the loss of *Pipselletkwe* specifically, are considered in the Agency and EAO's assessment of the seriousness of the potential impacts of Ajax to SSN's spiritual and cultural interests (section 24.4.2.5). SSN also raised a number of concerns about the interconnectedness of the water world and their fish relations, and how effects to water could impact fish and Indigenous fisheries. These concerns are summarized and considered in the Agency and EAO's assessment of the seriousness of the potential impacts of Ajax to SSN's rights and interests associated with fishing (section 24.4.2.1). SSN's concerns regarding stewardship of waters and watersheds are considered in the Agency's and EAO's assessment of seriousness of impacts to title (section 24.4.2.6).

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[82] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pipsell*; SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax

24.4.1.2 *Sky World and Grandfather Sky*

In reports produced during their assessment process, SSN explained the importance of sky world and the various elements and core concepts that are integral to it. The overarching concept is the "power of place" or *X7ensq't* – which is a relationship of reciprocal accountability between humans and the lands, water and sky. This relationship means that Secwépemc people must respect the land, water and sky – and if the laws are not respected, "the land and sky will turn on you"[83].

This reciprocal responsibility is found in historical, spiritual and cultural connection to places such as *Pípsell* and the prayer tree (*Kwecúsem'*) described in the Trout Children *Stseptékwll* and other oral histories. The oral histories associated with *Pipsell* are foundational to SSN laws. SSN has also noted that a calm and serene environment is necessary for them to ground themselves with the natural environment and establish and maintain a spiritual connection to their ancestors and the Sky World.

According to SSN, *Pipsell* and other specific places can be imbued with powers, medicines that act on people, anchor past experiences to land, and create the responsibility of stewardship. Specific stories and lessons are rooted in these places, which connect Secwépemc to their ancestors, intergenerational transfer of knowledge, and self-government. Impacts on specific locations such as *Pipsell* thus have a ripple effect to stories, laws, culture, intergenerational knowledge, self-government, and other interconnected Aboriginal rights. SSN has stated that disrespect in *Secwepemcúl'ecw* and the world have real ramifications and impacts on all people.

SSN has assessed Ajax as potentially having adverse impacts on Secwépemc way of life, *Pípsell* and *X7ensq't* in relation to:

- Cumulative noise, dust, pollution, movement and lights;
- Other relations that are absent from the area, including plants, animals, and fish;
- Disturbance of *X7ensq't* at *Pípsell* in relation to "its flow and feel and of its contentedness"[84], and the resulting loss of the power of place; and
- Impacts of reduced air quality and increased GHGs on Sky World, particularly with respect to the connection of climate change and *X7ensq't*.

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[83] SSN (2017) SSN Panel Recommendations Report, p. 45
[84] SSN Panel Recommendations Report 2017, p. 47

SSN stated that negative impacts on air quality would result in a fundamental breach of their right to live in their traditional territory, and have assessed the level of impact as "extremely severe"[85]. SSN's final conclusion related to Sky World and related considerations, such as loss of power of place and air quality/GHG emissions, is that the potential impacts of Ajax damage the reciprocal relationship between humans and the land, and causes harm to *Pípsell* – which in turn impacts the Secwépemc responsibility of stewardship.

During the EA, SSN identified a number of concerns related to the effects of Ajax on air quality. The Agency and EAO understand SSN's key concerns to be:

- The current air quality in the Kamloops area;
- A lack of air quality monitors installed near Secwépemc reserves;
- Concerns about KAM's air quality modelling;
- Two acid method of determining chemical composition of mine rock, leading to unreliable results related to extent and impact of particulate dispersion;
- Impact of using recycled water from Ajax to suppress dust on the roads and concerns that water would have a chemical load, which would be added to the dust on the road as it dries and then enter air as particulate;[86]
- No assessment of total aggregate data of the GHG carbon footprint of all activities, including transportation to Port of Vancouver, barge transport to final destination, and refining process;
- Increased traffic over the life of Ajax; and
- Population growth or activity changes in the area over the life of the mine.

Technical issues raised by SSN during the EA were considered in the Agency and EAO's review of the EIS/Application. Details of the Agency and EAO's assessment of the effects to air quality, including conclusions regarding the significance of potential effects and a description of legally binding EA Certificate conditions proposed by the EAO, can be found in Air Quality in section 8 of this Report. The following section provides a summary as it relates to the concerns raised by SSN.

As discussed in Air Quality (section 8), the Agency and EAO find that the magnitude of the residual effect to air quality would range from medium to high, and would be experienced within the regional study area. Concentrations of TSP, PM_{10}, $PM_{2.5}$, and dustfall would exceed the applicable regulatory criteria at the mine site boundary, but decrease with distance. By upper Aberdeen (approximately 2 km north of the mine site), the concentrations of particulate matter are predicted to be within applicable regulatory criteria, except for 24-hour average PM_{10}. There is substantial uncertainty associated with the air quality effects assessment, which affects the confidence in the estimated frequency of 24-hour average PM_{10} exceedances in upper Aberdeen. The Agency and EAO note that haul roads are the dominant source of emissions from Ajax, and find that effective dust management would be critical to managing air quality, should Ajax proceed. The Agency and EAO are of the view that 90% mitigation of dust from haul roads is unlikely to be achieved on a continuous basis at Ajax. The Agency and EAO find that there would be approximately 7 to 21 days per year where Ajax would result in concentrations of 24-hour average PM_{10} that exceed the BC Ambient Air Quality Objective of 50 $\mu g/m^3$ in upper Aberdeen. The Agency and EAO are of the view that the frequency of these exceedances is likely closer to the upper bound of this range, but could possibly be higher. Most of the exceedances would be expected to occur during the winter months under poor dispersion conditions. The Agency and EAO find that Ajax would also be a source of particulate matter and dust emissions during short term (e.g. less than an hour) dust storms, which are typically associated with dry, summertime conditions and high winds in the Kamloops region. These dust storms could produce very high concentrations of PM_{10} for periods of less than an hour, but may not necessarily result in exceedances of the 24-hour average air quality objectives.

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[85] SSN Panel Recommendations Report 2017, P. 49

[86] The Agency and EAO note that KAM does not intend to use recycled water for dust mitigation on roads.

To support an overall air quality management strategy for Ajax, and to help address uncertainties related to the air quality effects assessment, the EAO is proposing an EA Certificate condition that would require KAM to develop and implement an Air Quality Monitoring and Management Plan in consultation with SSN and relevant agencies. The EAO is also proposing an EA Certificate condition that would require KAM to retain the services of an Air Quality Reviewer who would be responsible for conducting regular data quality reviews of KAM's monitoring data, and providing information to stakeholders, including SSN.

SSN's views as to the nature and seriousness of impacts related to their cultural and spiritual practices, self-determination, and intergenerational transfer of knowledge, as conveyed through the concept of Sky World and related oral histories, have all been considered within the Agency and EAO's determination of the seriousness of impacts on SSN's asserted Aboriginal right to cultural and spiritual practices, and to SSN's asserted Aboriginal title, as well as to other rights where there is interconnectivity. The Agency and EAO understand that the intergenerational transfer of knowledge and notions of stewardship imbue the continued practice of most, if not all, Aboriginal rights.

24.4.1.3 *Holistic Health*

SSN defines holistic health as being comprised of "physical, mental, spiritual and emotional well-being guided by a set of unwritten beliefs and laws that support the survival of individuals, families, the communities, and the Nation".[87] According to SSN, the Trout Children *Stseptékwll* communicates two of the fundamental concepts related to holistic health: 1) the availability of foods and medicines on the land, and 2) the intergenerational transfer of knowledge.

With respect to the intergenerational transfer of knowledge, SSN has repeatedly stated how important that knowledge, and the transfer of it, is to the physical, mental and spiritual health of individuals and the community. Furthermore, SSN has explained how this knowledge is the foundation of cultural values such as self-knowledge, self-reliance, and responsibility for both the community and the environment. Due to the foundational importance of *Pípsell*, it is considered a key place for the transfer of knowledge and is irreplaceable to SSN.

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[87] SSN Panel Recommendation Report, p. 52

SSN asserts that the right to use and maintain *Pípsell* is a right to self-determination, which is a key determinant of health for Secwépemc people. With respect to the availability of traditional foods and medicines on the land, SSN notes the importance of medicinal plants and other ingredients found in the *Pípsell* area to the treatment of community member's ailments. They also note that it is important that the plants be free of contaminants to be effective.

SSN concluded that Ajax is likely to have adverse impacts on hunting, trapping, and plant gathering in the Ajax area, as well as on the intergenerational transfer of knowledge and the development of relationships between families. SSN considers the effects to plants and changes in SSN access to the mine site, as described in the EIS/Application, to be a significant impact on the holistic health of community members. SSN described how perception of risk in respect to contamination of plants, as well as impacts to the sense of place, would result in Secwépemc people not frequenting *Pípsell*. SSN views all of these impacts as contributing to an adverse impact on holistic health via loss of traditional foods and medicinal plants and the intergenerational transfer of knowledge. SSN has also stated that the presence of Ajax would work against ongoing initiatives to strengthen Indigenous knowledge, which they view as a key determinant of holistic health.

During the EA, SSN identified a number of concerns related to the effects of Ajax to SSN health. The key concerns raised by SSN include:

- Mine dust deposition resulting in increased metal levels in fish and country foods;
- Potential health effects to vulnerable populations; and
- SSN members' ability to access medical care, including a potential shortage of doctors following the departure of doctors hired by KAM.

Technical issues raised by SSN during the EA were considered in the Agency and EAO's review of the EIS/Application. Details of the Agency and EAO's assessment of the effects to health and health services, including conclusions regarding the significance of potential effects and a description of legally binding EA Certificate conditions proposed by the EAO, can be found in Part B of this Report. The following section provides a summary as it relates to the concerns raised by SSN.

In Human Health (see section 10), the Agency and EAO concluded that Ajax would cause a medium magnitude increase in human health risk due to inhalation exposures of particulates ($PM_{2.5}$ and PM_{10}) and that Ajax would cause a low magnitude increase in human health risk from inhalation of SO_2, NO_2, PAHs, and particulate-bound metals. The increase in health risk from total direct contact exposures to metals would be low to medium in magnitude.

The Agency and EAO concluded that KAM's commitment to developing and implementing a Fugitive Dust Management Plan would help to mitigate the health effects from inhalation of particulate matter and direct contact exposures to metals. KAM would be required to conduct ongoing environmental monitoring over the life of Ajax, including monitoring metal concentrations in soil, surface water, and plant and fish tissue, and implementing adaptive management measures if monitoring results indicated that effects were greater than predicted. The EAO is proposing an EA Certificate condition requiring KAM to provide regular human health reporting. The EAO is also proposing an EA Certificate condition that would require KAM to develop and implement an Air Quality Monitoring and Management Plan that would include a fugitive dust management component. Additional information is provided in Air Quality (section 8).

In consideration of SSN's concerns about the effects to their community associated with uncertainties regarding contamination of traditional foods near Ajax, KAM has also proposed to work with SSN to establish a committee to facilitate implementation of mitigations and monitoring of effects (see Human Health in section 10). In the assessment of effects to community wellbeing, the EAO concluded that there would be no residual effect to access to healthcare, in consideration of KAM's proposed onsite physician during construction and the low probability of traffic accidents and industrial accidents that could affect emergency room demand. The EAO is proposing an EA Certificate condition that would require KAM to prepare a Construction Workforce Accommodation and Health Services Plan, to mitigate for the potential increased demand that project personnel could place on non-urgent health care. Additional information can be found in Community Well-Being (section 11).

SSN also raised concerns that KAM's approach to health assessment does not adequately incorporate traditional Indigenous knowledge or take a holistic approach, including addressing the following:

- Impacts of self-determination on health;
- Impacts of perception of risk of contamination to plants, to sense of place and to social relationships including how perception of risk of contamination would affect power of place;
- Changes in access and use;
- Changes to environment affecting spiritual, emotional and mental health;
- Baseline data on Aboriginal consumption patterns and rates of country food;
- Mitigation measures to assist people who may get sick as a result of mine;
- A lack of consideration of the loss of plants (traditional food and medicine) from *Pípsell,* specifically as these plants are not readily found throughout SSN's asserted traditional territory and because SSN considered *Pípsell* to be a cultural keystone area based in part upon the presence of medicinal plants and traditional foods; and
- Project effects within the context of cumulative impacts of ongoing restrictions to use of traditional territory, including previous losses of food, medicinal plants, and opportunities for the transfer of intergenerational knowledge.

The Agency and EAO acknowledge SSN's interest in conducting a holistic health impact assessment that was specific to SSN communities and understand that, for this reason, SSN included such an assessment in the SSN Assessment Process, the results of which have been summarized above and are included in the SSN Decision Package.

SSN's views as to the nature and seriousness of impacts related to holistic health have been considered within the Agency and EAO's determination of the seriousness of impacts on SSN's asserted Aboriginal right to cultural and spiritual practices, and asserted Aboriginal rights to hunt, trap, and fish. The impacts that relate to *Pípsell* have been considered in the Agency and EAO's assessments of the seriousness of impacts on Aboriginal title. The Agency and EAO recognize that the intergenerational transfer of knowledge imbues most, if not all, Aboriginal rights and understand the link between this knowledge and a holistic health perspective.

24.4.1.4 *Intergenerational Teachings and Knowledge Transfer*

In reports produced during their assessment process, SSN communicated that their connection to the land reaches back for thousands of years and that this continued connection is fundamental to the intergenerational transfer of knowledge. SSN also described how their history and teachings are experienced and taught on the land and water. According to SSN, knowledge and memories regarding their Aboriginal rights are embedded in, and transmitted through, the *stseptékwll* that are rooted to specific locations. Because intergenerational knowledge transfer is integral to the healing and health of SSN people, SSN expressed that access to culturally important places is necessary.

SSN communicated that *Pípsell*, as a cultural keystone area, is a place where intergenerational transfer of knowledge takes place and where Secwépemc people went with their families to learn how to pay respect to the land and to ensure that they were not segregated from the land.

SSN has communicated that Ajax would cause an interruption in knowledge transfer at *Pípsell* and that this would result in the loss of this site specific traditional knowledge for all future generations, affecting spiritual, cultural, harvesting, and stewardship practices. SSN communicated in the SSN Decision Package that the intergenerational knowledge transfer unique to *Pípsell* would be permanently and irreparably harmed if Ajax is constructed.[88]

Effects to the intergenerational transfer of knowledge, and KAM's proposed mitigation measures for these effects, are discussed in the Agency and EAO's assessment of potential effects to the current use of lands and resources for traditional purposes, found in section 18 of this Report.

KAM's proposed measures to mitigate potential effects to SSN's intergenerational transmission of knowledge and skills included: efforts to accommodate employees' seasonal traditional practices; developing an Access Management Plan in consultation with SSN that includes provision for safe access for SSN members to Jacko Lake; supporting SSN to document past, present, and future land uses in the areas surrounding Ajax; supporting SSN to participate in accessing, harvesting, and/or documenting plants or other resources of cultural value prior and during project execution; and, collaborating with SSN to develop a program to monitor the harvesting of traditional foods throughout the year. SSN has communicated that these proposed mitigations are an inadequate colonial response that does not protect SSN's asserted traditional territory and resources.

Potential impacts on the loss of intergenerational knowledge are considered in the Agency and EAO's assessment of seriousness of impacts on SSN's asserted rights of fishing, hunting and trapping, plant gathering, metal and mineral mining, spiritual and cultural rights, and asserted Aboriginal title (see section 24.4.2).

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[88] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell

24.4.1.5 *Indigenomics*

SSN consider *Pípsell* to be of critical importance to their economy due to the cultural and ecological history in the area. SSN defines indigenomics as economic and social development that incorporates an indigenous perspective to better understand the importance of First Nations within regional and national economies. SSN describe their current economy as a hybrid that includes the following three sectors: Aboriginal economy; market economy; and state economy.

According to SSN, the Aboriginal economy is characterized by activities associated with cultural continuity and subsistence and includes hunting, harvesting, fishing, as well as land and habitat management and the maintenance of biodiversity. SSN identifies several important components of the Aboriginal economy including but not limited to intergenerational transfer of Aboriginal traditional knowledge, trading and bartering, and sharing of resources. The market economy, according to SSN, are economic interests in long-term sustainable economic development that embraces a prosperous community while ensuring that community economic developments are socially, culturally, and environmentally appropriate to SSN values. Market economy activities include leasing space, real estate, retail, agriculture, forestry, and minerals, among others. The state economy is comprised of funding provided by the federal government to the provincial government for core services. According to SSN, these services include health care, post-secondary education, social assistance, and social services, among other transfers.

SSN views the potential effects of Ajax on their seasonal round to be the most serious adverse impact to SSN's Aboriginal economy. The SSN Decision Package also identifies the following potential impacts:

- A loss of fish, animals and traditional plants and medicines, which could provide food, heat, clothing, and shelter to SSN members;
- Limitations to hunting and harvesting either through a loss of access to important areas, effects to animals, or through self-imposed SSN restrictions to harvesting activities;
- Impacts on members who rely on traditional harvested items as their primary source of income;
- Limitations to the ability of hunters and fishermen to provide food for poor people and single mothers in the Secwépemc Nation;
- Limitations to SSN members' ability to share resources within the Secwépemc Nation between communities and families; and
- Adverse impacts on SSN's Aboriginal economy from impacts on transmission of intergenerational knowledge, long-term interruption in SSN's use of *Pípsell*, loss of trade in copper and other metals, as well as loss of use of the land.

In the SSN Decision Package, SSN states that they are of the view that Ajax would "have a significant adverse effect on SSN's aboriginal economy that is not justified given the limited economic benefit of the Project."[89]

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[89] SSN (2017) SSN Panel Recommendation Report, p. 59

The EAO notes that in materials presented to SSN on February 15, 2017, the Province proposed to explore ways to address interests related to economic development. Further detail is provided in section 24.2.2.5 of this Report. No accommodation agreements have been signed at the time of this Report and in the SSN Decision Package, SSN Joint Council rejected the Province's proposed accommodation.[90]

KAM's EIS/Application assesses project related effects to Aboriginal economies. KAM's description of potential adverse effects of Ajax to Aboriginal economies is discussed in section 17 of Part B of this Report. KAM also describes potential project benefits associated with Aboriginal Economies, including:

- Project employment for SSN community members, particularly during the operations phase;
- Training opportunities that could enhance SSN's access to project employment;
- Procurement of SSN's business services, particularly during operations; and
- Potential benefits associated with the participation of SSN community members in wage employment.

SSN raised concerns regarding access to economic benefits associated with Ajax. The Agency and EAO understand SSN's key concerns to be:

- KAM's First Nations Human Resources Strategy is not adequate to ensure that SSN members will receive jobs at Ajax; and
- KAM has not provided meaningful assurances that KAM will seek to develop relationships with local SSN suppliers for contracting during the operational phase of Ajax.

In regard to SSN's concerns about access to employment and procurement benefits, KAM has proposed the following measures to facilitate SSN's access to benefits:

- Work with SSN to develop a First Nations Human Resources Development Plan, a skills training strategy, and a labour force database of SSN members;
- Work with SSN to maximize employment opportunities for the membership with an initial target of 30% of the full time employment at the mine. KAM would develop a First Nations Human Resources strategy that will provide guidelines for training and preferred hiring status for SSN members;
- Work collaboratively with SSN leadership, and local high schools to deliver a "don't drop out – complete high school" message to students attending high school career days and or community meetings about Ajax;
- Consider work experience equivalency to education or training in meeting qualification requirements for SSN mature workers with workplace experience;
- Provide cross-cultural training to Ajax employees;
- Develop a business procurement plan, with specific elements to enhance local and SSN business participation;

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[90] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pipsell*; SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax

- Engage with local and SSN businesses and include information sharing through the Community Liaison Group to identify issues and measures taken to implement project design and best management practices for labour competition; and
- The EIS/Application states that KAM is exploring opportunities with SSN to participate in business opportunities, such as timber salvage operations.

The Agency and EAO understand that SSN continues to negotiate a project agreement with KAM and that this agreement could include the following benefits: capacity funding for permitting and pre-mine joint development; start up and annual funding for SSN for participation on a joint SSN-KAM mine committee; culture and language funding; education funding; environmental certification approval bonus; benefit agreement signing bonus; annual benefit payments; full time employment commitments; and contracting and entrepreneur opportunities. The Agency and EAO acknowledge that SSN is not satisfied with the level of assurance that KAM has provided in regard to SSN's ability to access project benefits, including employment and procurement opportunities.

Potential impacts on the economic component of Aboriginal title are considered in the Agency and EAO's assessment of seriousness of impacts on SSN's asserted Aboriginal title (section 24.4.2.6).

24.4.2 ASSESSMENT OF SERIOUSNESS OF IMPACTS

24.4.2.1 *Fish and Aboriginal Fisheries*

This section provides a summary of what the Agency and EAO understand to be SSN's Aboriginal Interests related to fish and SSN fisheries. Please refer to the SSN Decision Package for a description told in SSN's voice.

SSN communicated that the practice of fishing extends beyond the act of harvesting fish for consumption, incorporating spiritual, ceremonial and social practices. In materials submitted as part of the EA, SSN communicated that Secwépemc people view fish as relatives and as members of an extended ecological family, sharing ancestry and origins. SSN described the wellbeing of their fish relatives as integral to the identity and to cultural ways of being for Secwépemc people. SSN asserted that they hold the right collectively with other Secwépemc Nations, to harvest fish throughout *Secwepemcúl'ecw*. SSN has asserted that they have the right to fish in Jacko Lake, Peterson Creek, Cherry Creek, and the other lakes, streams, and rivers that run through the project footprint and through SSN territory. SSN has also asserted that as the Secwépemc stewards of the Stk'emlupsemc region, they have: the responsibility and right to manage the fisheries, fish habitat and fish in the region including *Pípsell*; the right to use and manage fishing weirs, stations and locations in their asserted traditional territory; and the right to transmit knowledge and maintain connections to these locations.

SSN is of the view that Ajax would have "significant adverse effects on fish and fish habitat, the management and stewardship of fisheries and all of my relations who are fish relatives within *Secwepemcúl'ecw*, on available

Secwépemc food sources and the seasonal round, and result in a loss of intergenerational transfer of knowledge and adversely impact on our way of life and self-government."[91]

Analysis and Conclusions of the Agency and EAO

The following is the Agency and EAO's analysis of the seriousness of potential impacts of Ajax on SSN's asserted Aboriginal right to fish. The analysis is informed by the factors described in section 23.3, including the assessments of the following valued components:

- Surface water quality and quantity (section 2);
- Fish and fish habitat (section 4);
- Air Quality (section 8);
- Noise and Vibration (section 9);
- Human Health (section 10);
- Community Well-being (section 11); and
- Current Use of Lands and Resources for Traditional Purposes (section 18).

In reports provided during the EA, SSN communicated that members fish for a number of species throughout their asserted traditional territory, including Rainbow trout, Steelhead trout, Bull trout, Brook trout, Dolly Varden char, Kokanee salmon, Coho salmon, Sockeye salmon, Chinook salmon, Pink salmon, and burbot.

During the EA, SSN identified a number of concerns related to the potential biophysical effects of Ajax to fish and fish habitat. The Agency and EAO understand SSN's key concerns to be:

- Effects of construction and mining activities (e.g. noise, vibration, light levels) on fish, including causing fish mortality and adversely affecting health, growth, and reproduction;
- Removal of fish habitat in Jacko Lake due to the construction of the open pit;
- Loss of fish habitat and connectivity due to the construction of the Peterson Creek diversion culvert;
- Effects of reduced water flows in lower Peterson Creek, including alteration of fish habitat and a loss of habitat connectivity;
- Effects of water quality changes to fish, including the potential for contamination of fish;
- Catastrophic effects to fish and SSN's fishery if Jacko Lake were to drain into the open pit;
- Need for monitoring of effects to fish;
- Effects of water quality changes and reduced flow to coho and chinook salmonids at the confluence of lower Peterson Creek and the Thompson River;
- Cumulative effects to fish and fish habitat, including on fish populations and aquatic life downstream of Jacko Lake;

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[91] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 31

- Cumulative effects of water withdrawal from Kamloops Lake on salmon runs in the Thompson River system; and
- Adequacy of the proposed revised Conceptual Fish Habitat and Fishery Offsetting Plan to offset potential losses of fish habitat, and view that offsetting should be based on optimal rather than current conditions.

Technical issues that were raised by SSN in regard to the potential biophysical effects of Ajax on fish and fish habitat were considered during the Agency and EAO's review of the EIS/Application. Part B of this Report provides a discussion of related technical issues, including the Agency and EAO's conclusions regarding the significance of effects and a description of legally binding EA Certificate conditions proposed by the EAO. The Agency and EAO's conclusions as they relate to SSN's concerns are summarized below.

As described in Fish and Fish Habitat (section 4), the Agency and EAO expect that effects of Ajax on fish and fish habitat would be limited to Jacko Lake and Lower Peterson Creek and that Edith Lake would not be impacted. The Agency and EAO do not expect effects on fish and fish habitat in the Thompson River.

The Agency and EAO do not expect that water quality changes would affect fish in Jacko Lake or the Thompson River watershed. The Agency and EAO consider that the predicted concentrations of some water quality parameters could potentially affect growth and reproduction of aquatic life (fish and its food chain) in Peterson Creek. The Agency and EAO note there is uncertainty with respect to the effects on ecological receptors from project related changes in water quality. Refer to section 2 of this Report for additional details. The EAO has proposed EA Certificate conditions requiring KAM to develop and implement surface water quality management and monitoring plans, and a fisheries and aquatic life monitoring and management plan. With regard to water withdrawals from Kamloops Lake, the Agency and EAO are also of the view that any effects would be well within the range of natural variation and would have a negligible effect on the lake and downstream in the Thompson River system.

The Agency and EAO expect the residual effects of Ajax due to fish mortality and fish behavioural changes in Jacko Lake as a result of underwater noise and pressure from blasting in the open pit and sheet pile dam installation would be low in both magnitude and likelihood. The Agency and EAO expect the residual effects of Ajax due to changes in fish habitat would be medium in magnitude. Ajax would result in the permanent destruction of the northeast arm of Jacko Lake, resulting in a loss of 4% of the fish habitat in the lake and an estimated 5% to 10% of the total fish food production in Jacko Lake. The remaining area of the lake would continue to provide fish habitat and the losses would be offset through the Conceptual Fish Habitat and Fishery Offsetting Plan. During construction and operation, there would also be a loss of 3 km of fish habitat in lower Peterson Creek, where the creek is culverted through the mine site. This section of the creek has marginal habitat, with fish access limited to Rainbow trout from Jacko Lake entering the creek via the dam during seasonal high flows.

The Agency and EAO expect that Ajax could also potentially result in indirect fish habitat loss as a result of flow reductions in lower Peterson Creek. From September to April, flows could be lower than the in-stream flow guidelines although, according to the EIS/Application, this would still be sufficient to support small-bodied Rainbow trout. During the review period, KAM proposed to mitigate the predicted flow reductions in lower Peterson Creek by augmenting flows with water pumped from Kamloops Lake. With implementation of this measure, KAM would be able to maintain near baseline streamflow levels in lower Peterson Creek, which would minimize effects to fish habitat. To address uncertainties related to the long-term mitigation of streamflow losses in Peterson Creek, the EAO has proposed an EA Certificate condition requiring that KAM provide a long-term management strategy for streamflow in Peterson Creek and Jacko Lake that would address environmental flow needs and licenced surface water demand on the creek. Should Ajax proceed to permitting, DFO would require KAM to offset any serious harm to fish, in consultation with SSN and other relevant parties. KAM was required to develop a Conceptual Fish Habitat and Fishery Offsetting Plan and a revised plan during the EA process. The revised Conceptual Fish Habitat and Fishery Offsetting Plan was taken into consideration when assessing the potential environmental effects to fish and fish habitat. The revised plan proposes the following:

- Expansion of the western arm of Jacko Lake by approximately 2.6 hectares to compensate for lost fish habitat;
- Enhancement of existing poor-quality fish habitat at the outlet of Jacko Lake;
- Habitat restoration and enhancement of degraded sections of Upper Peterson Creek at the inlet to Jacko Lake; and
- Restoration of Lower Peterson Creek, including habitat enhancements to rearing habitat for Coho and Chinook salmonids as well as forage species in the South Thompson River system.

The Agency and EAO consider that the Conceptual Fish Habitat and Fishery Offsetting Plan would provide sufficient measures to address the direct and indirect habitat loss. The Agency and EAO note that SSN expressed views that the plan is not adequate in relation to SSN's Aboriginal right to fish.

The Agency and EAO concluded that, taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA Certificate conditions, Ajax is not likely to cause significant adverse environmental effects to fish and fish habitat.

SSN communicated that wherever there is a fish-bearing lake or stream in their asserted traditional territory, there is a SSN fishery. Fishing sites that SSN identified in the vicinity of Ajax include Jacko Lake, Peterson Creek, Edith Lake, Paul Lake, Trap Lake, Lac le Jeune, Thompson River, and Kamloops Lake. Key fishing sites identified by SSN that overlap with Ajax or predicted effects were considered in this assessment.

SSN emphasized that Jacko Lake and Peterson Creek are located in *Pípsell,* a site that SSN has identified as a cultural keystone area that is integral to their culture. The Jacko Lake outlet at lower Peterson Creek (Peterson Creek outlet) is the site of an important historical spring fishery for Rainbow trout for SSN. In spring, the spawning trout travel into the lower and upper Peterson Creek from Jacko Lake and SSN members harvest trout using snares. SSN also identified the upper Peterson Creek inlet to Jacko Creek as the site of a historical spring fishery.

SSN communicated that the Peterson Creek outlet is one of less than ten remaining documented outlet fishing stations in their asserted traditional territory, and that for many years due to privatization of lands, access to the spring trout fishery at this site has been limited. SSN has also informed the Agency and EAO that increasing variability and decreasing availability of anadromous salmon runs have caused SSN to place a greater sustenance value on inland fisheries and SSN has identified *Pípsell* as an ideal inland fishery for restoration.

In 2015 and 2016, SSN members conducted SSN's traditional spring trout fishery at the Peterson Creek outlet. KAM, as owners of the land the fishing station is on, permitted SSN's access to conduct the fishery. The upper Peterson Creek inlet to Jacko Lake was also identified as a historical spring trout fishery fishing station. In the spring of 2015, SSN also fished at this site, although no fish were caught. SSN indicated to the EAO that because Peterson Creek was flooding, the 2017 spring trout fishery was conducted at the dam on the west arm of Jacko Lake, which is on public property. The fishery was very productive, catching 550-600 fish.

During the EA, SSN identified a number of concerns regarding potential project impacts on the site-specific, spiritual, cultural, experiential and social aspects of their Aboriginal right to fish. The Agency and EAO understand SSN's key concerns to be:

- Destruction of the fishing station at the Peterson Creek outlet of Jacko Lake;
- Restrictions to access at Jacko Lake including the Peterson Creek outlet;
- Project related impacts on the quality of the fishing experience and associated spiritual and cultural practices including changes to the nature of the area and sensory disturbances (e.g., visual, noise, dust, increased access for other land users) and the overall presence of the mine;
- Potential health impacts of consuming fish that are contaminated by the mine;
- A reduction in SSN fishing as a result of any of the following:
    - SSN members might self-impose a fishery closure at Jacko Lake and the Peterson Creek outlet if there is a perception that the fish population has been adversely affected and is unsustainable;
    - SSN members might avoid fishing and eating fish due to perceived risk of contamination from the mine;
    - SSN members might chose not to fish at *Pípsell* due to the decreased quality of the experience; and
    - Employment at the mine conflicting with time spent participating in the seasonal round.

SSN has also communicated that fishing sites located elsewhere in SSN's asserted traditional territory cannot be substituted for Jacko Lake and Peterson Creek as these sites are located in *Pípsell,* a unique cultural keystone area that represents the physical embodiment of key components of the Trout Children *Stseptékwll* and is integral to the intergenerational transfer of knowledge.

Ajax would result in the permanent loss of the northeast arm of Jacko Lake. The remainder of the lake, including the Peterson Creek fishing stations at the outlet of Jacko Lake, would remain intact. The project design originally proposed in the EIS/Application would have resulted in the destruction of Peterson Creek outlet fishing station. During the EIS/Application review, KAM proposed an alternative design for the Peterson Creek diversion system that allowed the creek outlet to remain intact and to mitigate impacts on SSN's spring trout fishery in Peterson Creek and to address concerns raised by other members of the working group. The redesigned system would include additional mitigation to maintain flow and habitat in a 150m section of open channel immediately downstream of the Jacko Lake dam in order to avoid impacts on SSN's fishery. This revised Conceptual Fish Habitat and Fishery Offsetting Plan also includes planned habitat enhancements to one arm of Jacko Lake and to upper and lower Peterson Creek, thus facilitating SSN's spring trout fishery at these locations. To address SSN's concerns about effects to Jacko Lake fishery, KAM has committed to work with SSN to identify other potential options for habitat compensation and offsetting options within the asserted traditional territory.

Currently, access to Jacko Lake is via the public road and boat ramp and is unimpeded for the general public and SSN. To access the fishing stations at the lower Peterson Creek outlet of Jacko Lake and at the upper Peterson Creek inlet to Jacko Lake, KAM has established an access permission agreement with SSN that facilitates members entering the private land areas. This area is also fenced, signed and subject to safety requirements.

During construction and operation, SSN would continue to be able to access Jacko Lake, with some limitations, and KAM has indicated that it would continue to provide access to private lands in order for SSN to conduct the spring trout fishery. During the first 10 years of operations, access to the eastern half of Jacko Lake including the Peterson Creek outlet would be restricted daily for a period of up to 2 hours as a safety allowance zone for blasting. Project vehicles using Lac le Jeune Road, Inks Lake Road, and the Jacko Lake access road could also create some delays for SSN members accessing the fishery. To alleviate some of these delays, KAM plans to construct a new parking lot and access road at Jacko Lake. SSN has communicated that this measure could increase non-SSN presence in culturally important sites. In addition to communicating blasting schedules to SSN and posting signage, KAM has proposed to develop an Access Management Plan in consultation with Indigenous groups. The plan would address continued use of areas such as Jacko Lake and minimize changes to SSN members' access to Jacko Lake and the Peterson Creek outlet

As discussed in Air Quality (section 8) and Noise and Vibration (section 9), the Agency and EAO concluded that there would be residual effects resulting from noise, vibration, and dust, and acknowledge that the experience of fishing in areas near Ajax would be reduced during construction and operations. As discussed in Noise and Vibration (see section 9 of this Report), noise from Ajax would be most pronounced in close proximity to the mine site, including adjacent to Jacko Lake. Noise disturbances from Ajax are predicted to peak for three months during pile driving in the construction phase and in years 2, 4, and 8 of operation. Despite KAM designing their blasting schedule to reduce direct effects to fish and their prey, fish behaviour in response to blast underwater overpressure may also adversely affect catch rates. Noise from trucks would also be a disturbance and would be loudest near haul roads and the new Inks Lake exchange.

Ajax would cause elevated levels of dust and particulate matter. Although KAM has committed to mitigating 90% of the dust from haul roads, there is uncertainty regarding the effectiveness of the proposed mitigations and an extensive monitoring and dust management program is required. The Agency and EAO also concluded that there would be periodic, temporary, weather-driven increases in the amount of dust generated by Ajax. To minimize impacts on SSN's spring trout fishery, KAM proposes to avoid construction activities in Jacko Lake during the spring when SSN fishers are fishing at the Jacko Lake outlet to Peterson Creek. See Air Quality (section 8) for more information.

As discussed in Human Health (section 10), the Agency and EAO considered the aggregate effect of all direct contact exposure pathways for metal (including accidental ingestion of soil, dermal contact with soil, and consumption of country foods and drinking water) in assessing the total direct contact health risk. The Agency and EAO concluded that changes associated with metal exposures as part of direct contact exposure pathways would result in a low to medium magnitude effect.

As discussed in Current Use of Lands and Resources for Traditional Purposes (section 18), the practice of fishing at *Pípsell*, particularly the spring trout fishery, would continue to be available. However, SSN may choose not to fish at *Pípsell* due to the decrease in the experience of fishing, perceived risks to fish health, and concerns about contamination.

SSN has communicated that a reduction in fishing practices at *Pípsell* could result in a reduced ability to maintain cultural knowledge and transfer this knowledge to younger generations, including knowledge about fishing, associated fishing practices, how to care for fish and fish habitat, and place-specific knowledge about *Pípsell*. SSN has also stated that a reduction in fishing by members could negatively impact SSN members' connections to the land and the current spiritual awakening that the community is experiencing. It could also impact household economies, the seasonal round, and social networks. In SSN's Decision Package, SSN states that KAM's proposed measures are inadequate to mitigate the adverse impacts on SSN's Aboriginal right to fish.

To reduce the likelihood of SSN members avoiding fishing in Peterson Creek and Jacko Lake due to perceptions of contamination and concerns about the wellbeing of fish populations, KAM proposes to work with SSN to establish a committee to facilitate implementation of mitigations and monitoring of effects. KAM states that this mitigation could foster SSN members' knowledge regarding the ongoing effectiveness of the mitigations and whether mitigations are working as intended, potentially reducing the adverse social, cultural and spiritual impacts of a reduction or alteration in SSN's fishing practices at *Pípsell*. EAO has proposed an EA Certificate condition that would require KAM to develop a plan for involvement of SSN in environmental monitoring for all project stages, from pre-construction through operations.

The EAO has proposed an EA Certificate condition that would require KAM to develop a SSN Access Management Plan in consultation with SSN. The plan would be required to set out an approach to provide opportunities for SSN to engage in traditional land use practices on the site, as safety permits. SSN has raised concerns that Ajax would adversely impact intergenerational transmission of knowledge related to fish and SSN fisheries. See Intergenerational Teachings and Knowledge Transfer (section 24.4.1.4) for more information.

SSN raised the following issues in regards to KAM's assessment of impacts on SSN's fishery:

- The adequacy of the baseline information regarding SSN's trout fishery, including the need for a map of the locations of the exact impact on Peterson Creek and the corresponding Aboriginal rights and title affected; and
- Lack of baseline information describing the cumulative effects to alternative locations.

The Agency and EAO note that KAM requested additional fishing baseline information from SSN during the EA and that this information was not provided. KAM has proposed to support SSN in documenting past, present, and future land uses in the areas surrounding Ajax and in the larger asserted traditional territory, including fishing and the associated spiritual practices. SSN has communicated that KAM's proposed mitigations are an inadequate colonial response that does not protect SSN's asserted traditional territory and resources.

In consideration of the analysis of residual and cumulative effects to valued components, the information available from the SSN Assessment Process, the Agency's and EAO's consultation with SSN, SSN's engagement with KAM, KAM's proposed mitigations, and EAO's proposed EA Certificate conditions, the Agency and EAO conclude that Ajax would result in moderate-to-serious impacts on SSN's asserted Aboriginal right to fish.

24.4.2.2 *All My Relations: Flora (Plant Harvesting)*

This section provides a summary of what the Agency and EAO understand to be SSN's asserted Aboriginal Interests related to flora, including plant harvesting. Please refer to the SSN Decision Package for a description told in SSN's voice.

SSN communicated that Secwépemc people view themselves as relatives of all plants, sharing both ancestry and origins with plant relatives connected through an extended ecological family. The wellbeing of plants is integral to SSN identity and culture. SSN's various traditional uses for plants include food, medicine, technology, gifts and trade, and for spiritual or ceremonial purposes. SSN has asserted that, according to Secwépemc law, Secwépemc people collectively hold the rights to harvest plants in *Secwépemcúlecw*. More specifically, SSN has asserted that SSN holds the rights to harvest and gather timber and related materials such as bark, sap, and the cambium layer of trees, and to gather plants, roots, and parts of plants for food, traditional medicines, and technological uses (such as rope) including, without limitation, tea, wild potatoes, soap berries, other berries and indian hemp. SSN has provided information describing that under Secwépemc law, they are the caretakers of plants and ecosystems in the Stk'emlupsemc region and that they hold the right and responsibility to manage and act as stewards in the region and that they have a right to the knowledge, connections and management of these areas and the cultural threads that are foundational to Secwépemc members, families, communities and culture.

In the SSN Decision Package, SSN states that they are of the view that Ajax would have "significant adverse effects on plant and plant habitat, the management and stewardship of plant life within *Secwepemcúlecw*, on available traditional food sources and the seasonal round, and result in a loss of intergenerational transfer of knowledge and adversely impact on our way of life and self-government."[92]

Analysis and Conclusions of the Agency and EAO

The following is the Agency and EAO's analysis of the seriousness of the potential impacts of Ajax to SSN's Aboriginal right to gather plants. The analysis is informed by the factors described in section 23.3, including the assessments of the following valued components:

- Vegetation (section 5);
- Air Quality (section 8);
- Noise and Vibration (section 9);
- Human Health (section 10);
- Community Well-being (section 11); and
- Current Use of Lands and Resources for Traditional Purposes (section 18).

SSN's Cultural Heritage Study identifies 127 species of plants that are or were harvested by SSN members in the vicinity of Ajax.[93] Plants harvested for food include:

- Berries (e.g., saskatoons, wild strawberries, soapberries, raspberries, kinnikinnick, choke cherries, rose hips, gooseberries, squaw current, hybrid Oregon grape, Rocky Mountain juniper, red osier dogwood); and
- Roots (e.g., wild onion, yellow bells, arrow leaved balsam root, sagebrush mariposa lily, burdock, fireweed, edible thistle, cow parsnip, tiger lily, parsley, mountain sweet cicely, shrubby penstemon, water parsnip, cattail, qweoewile).

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[92] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pípsell*, p. 36
[93] Ignace, M. (2014) Cultural Heritage Study – Final Report, p. 108-109

Other food plants, such as Jack pine cambium, stinging nettles, brittle prickly pear cactus, field mint, lambs quarters, asparagus, black tree lichen, orange green coloured wolf lichen, and a number of plants harvested for their medicinal properties. As discussed in Current Use of Lands and Resources for Traditional Purposes (see section 18 of this Report), the practice of plant gathering would be affected as Ajax would result in the loss of occurrences of traditional plants that are harvested by aboriginal persons, and the time required for grassland reclamation efforts means that the effects could extend beyond the life of Ajax.

SSN has also identified a number of plants that are, or were, harvested for their medicinal qualities, including the following: yarrow, baneberry, short beaked agoseris, saskatoon, cut-leaved anemone, low pussytoes, rosy pussytoes, wild sarsaparilla, heart leaved arnica, northern wormwood, tarragon, big sagebrush, showy milkweed, lady fern, water birch, sagebrush mariposa lily, thompson's paintbrush, hoary false yarrow, fireweed, Douglas's water hemlock, blue clematis, narrow leaved collomia, pale comandra, red osier dogwood, slender hawksbeard, few flowered shooting star, common horsetail, smooth horsetail, cut leaf daisy, thread leaf fleabane, linear leaved fleabane, Douglas fir, pink wintergreen, squaw current, black gooseberry, red raspberry, willows, lance-leaved stonecrop, hooshum, soapberry, Menzies's campion, birch leaved spirea, common snowberry, western meadowrue, meadow death camas, cattail, stinging nettle, and kinnickinnick.

SSN has communicated that of the 127 culturally important species they identified, "no less than 90 species had medicinal uses, 45 were used as food, 47 were used technologically, 14 had structural values, 6 had spiritual significance, 7 were used in ceremony, at least 5 were used as ecological indicators and 29 had other uses important to the everyday life."[94] According to SSN, 40 of the species of plants identified at the proposed site are cultural keystone species. Additionally, many of these species of plants provide sustenance and habitat for animals.

SSN communicated that due to previous disturbances, some important plant species have been completely extirpated from the mine site and many others that are still present have been greatly reduced in abundance and quality. According to SSN, staples of SSN diet such as bitterroot, spring beauty or Indian potato, mariposa lily, and balsamroot, would have been abundant at much of the mine site.

During the EA, SSN identified a number of concerns related to the potential biophysical effects of Ajax to plants. The Agency and EAO understand SSN's key concerns to be:

- Effects to any and all of the plants identified as of value to SSN, including foods, plants, including rare plants, herbs, and medicinal plants;
- Effects to plants of trampling during construction and operations;
- Effects to grasslands, wetlands, and biodiversity;
- Uncertainty regarding proposed reclamation of native grasslands;
- Effects to red and blue listed plant communities;

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[94] SSN (2017) SSN Pipsell Impacts and Infringements Report, section 6 P. 11

- Contribution of Ajax to existing cumulative effects to important traditional foods, medicinal plants species and ecosystems within their asserted traditional territory, including effects of non-native plants such as noxious weeds and effects caused by ranching and industrial activities; and
- Concerns regarding KAM's assessment methods and Habitat Suitability Models.

Technical issues that were raised by SSN in regard to the potential biophysical effects of Ajax on vegetation were considered during the Agency and EAO's review of the EIS/Application. Part B of this Report provides a discussion of key technical issues, including the Agency and EAO's conclusions regarding the significance of effects and a description of any legally binding EA Certificate conditions proposed by the EAO. The Agency and EAO's conclusions, as they relate to SSN's concerns, are summarized below.

As discussed in Vegetation (section 5) and in Current Use of Lands and Resources for Traditional Purposes (section 18), of the 127 culturally important plant species identified by SSN, KAM found occurrences of 114 species in the vegetation local study area, 53% of which are grassland species and 38% are wetland or riparian species. The following 13 species were found growing within the Ajax footprint: yarrow, Saskatoon, big sagebrush, sedges, red-osier dogwood, Rocky Mountain juniper, lemonweed, qweoewile/large-fruited desert-parsley, ponderosa pine, Douglas fir, willows, soapberry, and cattail. The three occurrences of cattails noted during KAM's studies are entirely within the locations of project infrastructure and would be removed. None of the other species would be removed in their entirety from the mine site. KAM reported that all traditional plant species identified by SSN are provincially considered common (yellow-listed) or are an introduced or exotic species, and therefore were not brought further into the vegetation effects assessment.

The EA considered the effects of Ajax on the loss, alteration, and degradation of grasslands, wetlands and rare plants in the project footprint and in the local study area. See Vegetation (section 5 of this Report) for additional information. The EA did not evaluate effects on vegetation species whose populations are widespread and secure.

Grasslands

Ajax would cause 1,002 hectares of grassland habitat in the project footprint to be lost during construction. Another 775 hectares may have some habitat alteration/deterioration as a result of construction activities and linear feature maintenance, and up to 414.4 hectares of grasslands in the local study area could experience altered/degraded habitat because of increased invasive species. These lost and altered grasslands may be host to some provincial-listed plant species. The loss or alteration of grasslands due to Ajax equates to 3% of grasslands in the regional study area. KAM would reclaim
1,125 hectares of grassland habitat through reclamation and revegetation processes as part of the Landscape Restoration Plan, which would be designed to approximate existing grassland topography and species composition. The 299 hectares open pit area would not be reclaimed. There is uncertainty about the extent and timelines for reclamation and restoration/enhancement success and the Agency and EAO acknowledge SSN's view that reclaimed grasslands landscape post-mining would not have the same quality or characteristics as the current grasslands.

To address the habitat loss and alteration effects to grasslands and grassland-dependent species during construction and operations, KAM would develop and implement a grassland enhancement program on 2,093 hectares of KAM-owned land west of the Ajax infrastructure development area but still within the regional study area. The plan would involve measures to reduce invasive species, restore grasslands by thinning young forest and sagebrush areas, and protect restoration and riparian areas from cattle trampling. The EAO has proposed an EA Certificate condition requiring that the grasslands restoration and enhancement plan be developed in consultation with SSN and relevant government agencies. To support the management and reduction of invasive species that are already abundant and have degraded the native grassland habitat at the mine site, the EAO has proposed an EA Certificate condition requiring KAM to develop and implement a construction environmental management plan that includes invasive plant management.

Wetlands

The Ajax local study area includes both permanent and ephemeral wetlands that would be lost and altered during construction and operations. The Agency and EAO note that KAM predicted the loss of 38.6 hectares of permanent and ephemeral wetlands in the project footprint, and the alteration and impaired functionality of an additional 31.6 hectares in the infrastructure development area. KAM committed to the creation of 28.7 hectares of replacement wetlands, designed in accordance with the Federal Policy on Wetlands Conservation. The EAO has proposed an EA Certificate condition requiring that KAM design and implement a Wetland Compensation Plan to offset wetland function loss, developed in consultation with SSN and applicable provincial and federal agencies. The plan would include monitoring and a follow-up program.

Rare plants

The Agency and EAO acknowledge that rare plants are, by their nature, not resilient to changing conditions as their habitats are typically specialized and spatially limited. Given past disturbance, available habitat for rare plants at the mine site is already compromised. At the same time, data on rare plants distribution and abundance in the region is not extensive.

Baseline studies identified 55 rare plant occurrences, and reported that 35% of those would be lost within the project footprint and another 36% would have their habitat altered. These plants include rare lichens, vascular plants, and mosses, whose regional populations are not well understood.

The EAO has proposed an EA Certificate condition requiring that KAM conduct additional rare plant surveys prior to construction. The EAO has also proposed a condition requiring KAM to develop and implement a vegetation management and monitoring plan that includes avoidance and mitigation measures for rare plants and rare ecological communities. KAM has also committed to support regional rare plant surveys and research to support greater understanding of the distribution of these rare plants species throughout the region.

The Agency and EAO concluded that, with the implementation of mitigation measures and EA Certificate conditions, there would not be significant adverse effects to grasslands, wetlands, or rare plant communities. The Agency and EAO have also concluded that Ajax would not result in significant cumulative adverse effects to grasslands, wetlands, or rare plant communities in the region.

SSN has communicated that the mid to upper elevation grasslands and the grassland forest interface in the vicinity of Ajax are a very important part of SSN's seasonal round. The area surrounding the mine site provides opportunities for early spring plant gathering because of its low elevation and because it is usually snow free by February or March. Roots are gathered on the hills around Jacko Lake. SSN has also communicated that in addition to its cultural significance, *Pípsell* is a preferred plant harvesting area due to its location near the confluence of the North and South Thompson Rivers and proximity to SSN communities, and due to the unique mineral content of the underlying soil. SSN has described *Pípsell* as the ideal traditional "garden site".[95] SSN considers *Pípsell* to be a cultural keystone area based in part on the presence of medicinal plants and traditional foods. Other important harvesting sites in the vicinity of Ajax include Knutsford and Cherry Creek.

Currently, access to the proposed mine site – including both the Crown land and private land – is limited by fencing and signage. In recent years, KAM has provided access to SSN to conduct cultural practices on site.

During the EA, SSN identified concerns regarding potential Ajax impacts on the site-specific, social, cultural, spiritual and experiential aspects of plant gathering. The Agency and EAO understands SSN's key concerns to be:

- Reduced access to culturally important traditional harvesting areas;
- Impacts on or reduced availability of traditional foods and medicinal plants that are not readily found elsewhere in SSN's territory;
- Reduced availability of resources for SSN seasonal round;
- Removal or alteration of ecological communities including grasslands and areas important for collecting berries and root vegetable foods, medicinal plants, and plants required for technological and ceremonial, thereby affecting the availability and quality of plants within their asserted traditional territory and leaving SSN without food and medicines, or the ability to share these resources and support others in their communities;
- Plants growing on the site after reclamation would not possess the same medicinal qualities due to the removal of the underlying minerals;
- Effects to spiritual and cultural practices such as sweats, if the appropriate plants are not available, in good health, and uncontaminated;
- Increased presence of non-SSN members in culturally important harvesting sites;
- Health impacts of consuming plants that are contaminated by the mine;
- Impacts on the nature of the area including sensory disturbances (e.g., visual, noise, dust, increased access for other land users) and the overall presence of the mine;
- Reduced likelihood that SSN members would continue to use the area for cultural practices due to a change in its nature;
- Impacts on intergenerational transfer of knowledge, including the loss of opportunities to pass geographically specific cultural knowledge and traditions to future generations of Secwépemc people, including knowledge regarding the plant-gathering process and about areas where specific plants grow;
- The expansion of the west arm of Jacko Lake at the expense of existing wetland habitat and associated plant life and that this measure, which is meant to offset fish habitat losses, does not align with Secwépemc culture and beliefs; and

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[95] Ignace. 2014 Cultural Heritage Study, p 118- 119

- Other areas cannot be substituted for *Pípsell* because it is a cultural keystone area and thus the activities conducted at the mine site are not transferrable elsewhere.

SSN also communicated that they are deeply concerned about the potential contribution of Ajax to existing effects within their asserted traditional territory, including effects on traditional plants and medicinal plants, which have already occurred through the introduction of non-native plants, including noxious weed species, continuous ranching, and industrial activities. SSN stated that they are of the view that each project furthers the already serious negative environmental damage that has occurred within their territory since contact with Europeans. SSN stated that some of the traditional plants and medicinal plants cannot be collected in other areas of their territory because the cumulative effects, including continuous ranching and industrial activities over the past 100-160 years, have affected the abundance of critically important food and medicinal species. SSN detailed the ecological conversion that took place in the late 19th and early 20th centuries at *Pípsell*, an area the SSN considered one of their main 'bread baskets'.[96]

Currently SSN's access to the mine site and surrounding areas is limited as much of the area is fee simple land and the Crown-owned parcels are completely surrounded by fee simple lands where access can be restricted by the fee simple owner. Over the course of construction and operations, Ajax would result in further access restrictions to the 1700 hectares mine site and the surrounding safety zones. During mine construction, operation, decommissioning and closure, currently existing roads within the mine site would be closed, affecting access to certain areas, including portions of Goose Lake Road. Access and use restrictions are expected to persist for the full life of Ajax, from the commencement of construction through to the completion of active closure and reclamation activities.

KAM has also proposed to develop an access management plan to facilitate SSN's continued use of preferred cultural use sites in close proximity to Ajax. KAM has stated that the proposed new Jacko Lake access road and parking lot would facilitate continued SSN access to nearby root gathering sites. The Agency and EAO acknowledge SSN's view that access restrictions cannot be mitigated and that the development alterative access routes is an unacceptable mitigation as it would increase the presence of non-SSN members in areas used for cultural and spiritual practices, adversely impacting the experience.

The EIS/Application includes plans to reclaim the mine rock storage facilities and tailings storage facilities. Given the uncertainty regarding reclamation and the permanent changes to the mine site resulting from the removal of the underlying metals, it is likely that even following closure and reclamation, the mine site would not be able to fully support SSN plant gathering as SSN has described it. Additionally, the 299 hectares open pit would not be reclaimed, and over time would fill with water.

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[96] Ignace (2014) Cultural Heritage Study, p. 102.

To mitigate the post-closure impacts on plant gathering and reclamation, KAM has proposed a suite of mitigation measures that includes implementation of a collaborative approach to reclamation with SSN and could include providing funding and support for on-going reclamation research, and incorporating SSN input into identification and siting of plants for re-vegetation.

SSN has expressed concern that KAM's proposed approach to grassland restoration transfers the risk of mitigation shortfalls to SSN whereby, if mitigations are ineffective and grasslands cannot be restored, their cultural and spiritual practices and obligations would be irreversibly impacted.

The Agency and EAO concluded that there would be residual effects resulting from noise, vibration, and dust, and acknowledge that the quality of the experience of plant gathering activities in areas near the mine site would be reduced during construction and operations. These effects are summarized in the preceding discussion of impacts to SSN fishing, and discussed in greater detail in Noise and Vibration (section 9), Air Quality (section 8), and Current Use of Lands and Resources for Traditional Purposes (section 18).

As described above, the Agency and EAO anticipate that increases in metal exposure for the direct contact exposure pathway would result in a low to medium magnitude effect. The Agency and EAO note that KAM would implement additional mitigation measures as required. The EAO is proposing an EA Certificate condition that would require KAM to report on human health risk from Ajax in consideration of monitoring data, including air quality, water quality, soil, plant, and fish tissue monitoring data. See Human Health (section 10) for more information.

KAM proposes to work with SSN to establish a committee to facilitate implementation of mitigations and monitoring of effects. KAM states that this mitigation could foster SSN member's knowledge regarding the ongoing effectiveness of the mitigations and whether mitigations are working as intended, potentially reducing the adverse social, cultural and spiritual impacts of a reduction or alteration in SSN's plant gathering near the mine footprint. SSN has not commented on the potential efficacy of this mitigation for their communities.

To mitigate SSN's concerns regarding Ajax's contribution to cumulative effects to SSN plant gathering throughout their asserted traditional territory, KAM has proposed to work with SSN to identify potential options for habitat compensation and offsetting options; to investigate the need for future studies on biodiversity in the region to determine the possible role of Ajax or other industrial activities in future conditions as they relate to harvested species; and, to support SSN in documenting past, present and future land uses in the areas surrounding Ajax and in the larger traditional territory.

The Agency and EAO acknowledge SSN's view that wetland compensation measures associated with expansion of the west arm of Jacko Lake do not align with Secwépemc culture and beliefs.

SSN has also raised substantial concerns that Ajax would adversely impact intergenerational transmission of knowledge related to plant gathering. In regard to intergenerational transmission of knowledge, section 24.4.1.4 of this Report summarizes SSN's concerns and describes KAM's proposed mitigations.

The EAO has proposed an EA Certificate condition that would require KAM to develop an SSN Access Management Plan in consultation with SSN. The plan would be required to set out an approach to provide opportunities for SSN to engage in traditional land use practices on the site, as safety permits.

SSN also raised the following concerns with regard to KAM's assessment of the potential impacts of Ajax on SSN's plant gathering:

- Failure to include information on the use of traditional plants and the significance to SSN;
- A lack of mapping of the extent of the loss of harvesting areas affected; and
- A lack of information about plant gathering locations at Goose Lake and Goose Lake Road.

The Agency and EAO note that in October of 2014, KAM provided SSN with funding to conduct an additional phase of the Cultural Heritage Study that would have included documentation of traditional plant gathering practices and harvesting sites. Although the proposed completion date for the study was February 2015, the study was not provided by SSN at the time the EIS/Application was written, or at the time of writing of this Report. If the study is completed and made available, KAM has committed to take it into account during the next phases of Ajax, including permitting and detailed engineering. To further mitigate these effects, KAM has committed to provide support, as appropriate, to SSN to participate in documenting plants or other resources of cultural value prior to and during project execution. SSN has communicated that these proposed mitigations are an inadequate colonial response that does not protect SSN's asserted traditional territory and resources.

In SSN's Decision Package, SSN stated that KAM's proposed measures are inadequate to mitigate the adverse impacts on SSN.

In consideration of the analysis of residual and cumulative effects to valued components, the information available from the SSN Assessment Process, the Agency and EAO's consultation with SSN, SSN's engagement with KAM, KAM's proposed mitigations, and the EAO's proposed EA Certificate conditions, the Agency and EAO conclude that Ajax would result in moderate-to-serious impacts on SSN's asserted Aboriginal right to gather plants.

24.4.2.3 *All My Relations: Fauna (Hunting and Trapping)*

This section provides a summary of what the Agency and EAO understand to be SSN's Aboriginal Interests related to fauna, including hunting and trapping. Please refer to the SSN Decision Package for a description told in SSN's voice.

SSN communicated that Secwépemc members view animals as relatives, rather than as commodities for sustenance. Information provided by SSN during the EA describes that when harvesting an animal, Secwépemc members understand the animal to be "offering or abandoning their life" and they give recognition and acknowledgement to their animal relative through payer, offerings and fully utilizing the animal's body.[97] SSN has asserted that they have the Aboriginal right to hunt and trap various animals including, without limitation, elk, deer, moose, mountain goat, mountain sheep, rabbit, marmot, ground hog, and gophers. SSN has communicated that under Secwépemc law, in addition to the right to harvest animals in their asserted traditional territory, SSN has a right and an obligation to care for their animal relatives in SSN territory and to maintain the environment upon which animals depend. The care and management of the animals is necessary to ensure the ongoing health and the longevity of both animals and Secwépemc (as familial relations).

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[97] SSN (2017) SSN Pípsell Impacts and Infringements Report, p. 1

In the SSN Decision Package, SSN stated that Ajax would have "significant adverse effects on the fauna that live in our territory. These adverse effects will include the destruction of wildlife habitat, impacts on available food sources and the seasonal round, loss of opportunities for intergenerational transfer of knowledge, and impacts on our way of life and self- government."[98]

Analysis and Conclusions of the Agency and EAO

The following is the Agency and EAO's analysis of the seriousness of the potential impacts of Ajax to SSN's Aboriginal right to hunt and trap. The analysis is informed by the factors described in section 23.3, including the assessments of the following valued components:

- Wildlife (section 6);
- Air Quality (section 8);
- Noise and Vibration (section 9);
- Human Health (section 10);
- Community Well-being (section 11); and
- Current Use of Lands and Resources for Traditional Purposes (section 18).

Based on the information provided by SSN during the EA, SSN members hunt and trap a number of species of fur-bearers, ungulates, rodents, and birds. The hunted and trapped species known to be in the vicinity of Ajax include black bear, coyote, grey wolf, cougar, lynx, bobcat, mule deer, moose, porcupine, beaver, hare, marmot, squirrel, and muskrat. SSN communicated that deer and moose are currently the species most frequently harvested at the mine site and in the adjacent area, but that black bear and grouse are also harvested. A number of species that were previously harvested in the area, including sheep, grizzly bear, caribou, and elk, are now extirpated or extremely rare. According to the EIS/Application, SSN informed KAM that badger, grouse, moose, and grizzly bear were species of particular concern.

During the EA, SSN identified a number of concerns related to the potential biophysical effects of Ajax to wildlife and wildlife habitat. The Agency and EAO understands SSN's key concerns to be:

- The adequacy of the baseline information collected by KAM, including information pertaining to wildlife and reptiles;
- Effects to biodiversity;
- Effects to animals other than deer and moose, such as red squirrel, snowshoe hair, muskrat, beaver, red fox, porcupine, American mink, marten, coyote, grey wolf, chickadee, red headed woodpecker and American black bear;

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[98] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 41

- Effects to grouse, including impacts of vibration, loss of the grouse dance houses (leks), cumulative effects, and concerns regarding efficacy of mitigation;
- Effects of noise and vibration from blasting and pile driving to wildlife, including organisms in vulnerable life stages;
- Effects to species at risk and their habitat;
- Effects to migratory birds and their wetland habitat;
- Barriers to wildlife movement; and
- Cumulative impacts to grasslands and how this would impact wildlife.

Technical issues that were raised by SSN in regard to the potential biophysical effects of Ajax on wildlife were considered during the Agency and EAO's review of the EIS/Application. Part B of this Report provides a discussion of related technical issues, including the Agency and EAO's conclusions regarding the significance of effects and a description of any legally binding EA Certificate conditions proposed by the EAO. The Agency and EAO's conclusions as they relate to SSN's concerns are summarized below.

In Wildlife (section 6), the Agency and EAO considered effects to amphibians, reptiles, migratory birds, raptors, non-migratory gamebirds, badgers, and bats, with a particular focus on species that are of regional concern, or that are listed species known to be vulnerable to habitat or population loss. Wildlife species that hold special traditional importance for SSN, but which population is considered widespread (e.g. moose) in the region, or species that have been extirpated from the area (e.g. elk) were not quantitatively assessed by KAM for potential effects from Ajax.

The Agency and EAO concluded that there would be residual adverse effects to the following wildlife valued components and indicator species:

- Great basin spadefoot: loss and alteration of wetland habitat, direct mortality, and exposure to chemical hazards;
- Migratory birds, including waterfowl, sandhill crane, and great blue heron: loss and alteration of wetland habitat and exposure to chemical hazards;
- Raptors: loss and alteration of grassland nesting and foraging habitat;
- Sharp tailed grouse: loss and alteration of grassland habitat and lek sites, sensory disturbance at lek sites, and direct mortality;
- American badger: loss and alteration of habitat, sensory disturbance, disruption of movement, and road mortality; and
- Little brown myotis: loss and alteration of roosting habitat and exposure to chemical hazards.

To address the range of potential adverse residual effects to these species, the EAO proposed an EA Certificate condition requiring KAM to develop and implement a Wildlife Management and Monitoring plan, a Vegetation Management and Monitoring Plan, a Wetland Offsetting Plan, and a Grasslands Enhancement Plan, prior to Construction. Given the uncertainty about regional cumulative impacts to American badger, the EAO has proposed an EA Certificate condition that would require KAM to provide support to the Province's Badger Recovery Team. All of these would be implemented to support habitat areas of importance to wildlife, and all of these plans would require consultation with SSN during development and implementation. KAM acknowledged that further mitigation measures and adaptive management would be required, which would be identified through additional data collection and verification. As such, the EAO has also proposed an EA Certificate condition requiring KAM to conduct pre-construction surveys of wildlife and vegetation to enable the identification and implementation of any additional, site-specific mitigation measures, as required.

The Agency and EAO expect that Ajax would result in residual effects due to loss and alteration of habitat, sensory disturbance, disruption of movement, direct mortality, and exposure to chemical hazards that would affect the wildlife valued components assessed in the EIS/Application. The Agency and EAO expect these project effects on wildlife indicator species would be felt locally and regionally, and could last into the far future. Project effects could be reversible in the long-term to far-future, with the exception of habitat loss for sharp-tailed grouse and badger, and direct mortality. Depending on the success of the grassland restoration, the residual effect to sharp-tailed grouse would likely be partially reversible for some grouse habitat requirements; however, both the success of grassland restoration and the utilization of restored grasslands by American badger are uncertain.

The Agency and EAO concluded that, with the implementation of mitigation measures and EA Certificate conditions, there would not be significant adverse residual effects or significant adverse cumulative effects to amphibians, reptiles, migratory birds, raptors, non-migratory game birds, badgers, and bats. During the EA, SSN provided information that describes how members historically hunted and trapped throughout their asserted traditional territory, including the mine site and the adjacent areas. The mine site includes the hunting blind complex (section 24.1.3) that SSN has described is the last intact hunting blind in their traditional territory. SSN communicated that members continue to hunt in and around the mine site, including near Jacko Lake, Peterson Creek, and Goose Lake, although access is now limited due to fences and the privatization of land. SSN members have reported that the mine site is a refuge for game species, including exceptionally large deer with unique behavioural characteristics. Other reported hunting locations in the vicinity include the Sugarloaf Ranch areas, Lac Le Jeune, Chuwels Mountain, Greenstone Mountain, Knutsford, and south of Kamloops Lake to Stump Lake.

Since 2013, an SSN member has owned a trapline near Greenstone Mountain. SSN has also communicated that a member owns an active trapline in the area of Jacko Lake and that non-registered trapping activity might occur in the vicinity of Ajax, but at the time of writing this Report, SSN had not responded to requests from KAM and the EAO for additional information.

During the EA, SSN identified concerns regarding potential impacts of Ajax on the site-specific, social, cultural, spiritual and experiential aspects of hunting and trapping. The Agency and EAO understands SSN's key concerns to be:

- Loss of the hunting blind, including the loss of ability to share site-specific hunting knowledge and skills with younger generations;
- Appropriate maintenance of the unique characteristics of hunting and trapping grounds for each species is contingent upon, and integral, to intergenerational transfer of knowledge;
- Loss of access to the mine site for hunting and trapping;
- Other areas cannot be substituted for the areas that would be impacted by Ajax for the following reasons:
  - SSN has identified *Pípsell* is a cultural keystone area;
  - Traditional ecological knowledge that is specific to *Pípsell*, can only be transmitted at *Pípsell*;
  - The mine site is a refuge for game that are abundant and demonstrate behavior and characteristics making it an appropriate hunting training ground; and

    - There is insufficient information regarding alternative sites and cumulative effects;
- Impacts on trapping activities, including an onsite trapline;
- Impacts on undocumented historical hunting camps and cabins that have the potential for future use;
- Impacts on the nature of the area (e.g. visual, noise, dust, presence of the mine, presence of non-SSN) would reduce the likelihood that SSN members would continue to use the area for hunting and trapping;
- Cumulative impacts on hunting and trapping throughout their traditional territory resulting in SSN members having to travel farther, hunt for longer, and expend more resources to support their families and communities; and
- Impacts on the seasonal round.

Over the course of construction and operations, Ajax would result in limited SSN access to approximately 1,700 hectares, including hunting and trapping sites located within that area, including the permanent loss of the Goose Lake area. SSN's access to the mine site and surrounding areas is currently limited, as much of the land is fee simple and the Crown-owned parcels are completely surrounded by fee simple lands where access can be restricted by the fee simple owner. The EIS/Application includes plans to reclaim the mine rock storage facilities and tailings storage facilities, although there is some uncertainty regarding whether and when the proposed reclamation methods would return these areas to a state that could fully support SSN's activities. The 299 hectares open pit would not be reclaimed, and over time would fill with water. SSN is of the view that access restrictions cannot be mitigated.

SSN has indicated that the hunting blind complex is important for intergenerational transmission of knowledge related to hunting. KAM has stated that the hunting blind is located within the proposed site of the open pit, and thus it is unavoidable. KAM has proposed to develop a mitigation strategy for the site in discussion with SSN and the Archaeology Branch of the MFLNR. KAM indicated that mitigation measures could include consultation with SSN and reconstruction of the petroforms at another location that could be accessed by SSN, documenting the hunting blind complex using 3D imagery, preparation of a documentary or scaled 3D model of the hunting blind complex for educational purposes, and funding for heritage education or other relevant programming. KAM has also proposed to relocate specific features of the hunting blind to a museum. SSN does not support mitigation measures that would document, move, or reconstruct the hunting blind, and has stated that the hunting blind complex only maintains its value in situ. In addition to the loss of the hunting blind complex, SSN has raised concern that Ajax would adversely impact intergenerational transmission of knowledge related to hunting and trapping. SSN has stated that they view KAM's proposed mitigations as inadequate.

SSN has expressed concern about the potential loss of undocumented historical hunting camps and cabins and inadequacy of KAM's documentation of baseline use of the proposed mine site by SSN members. As previously discussed in section 24.2.3 of this Report, KAM provided funding for two phases of the Cultural Heritage Study. Phase Two was not available at the time of writing this Report. KAM has proposed to provide support, as appropriate, to SSN to participate in documenting resources of cultural value prior to and during project development with the aim of facilitating SSN involvement in future land use planning for consideration in the Reclamation and Closure Plan.

The Agency and EAO concluded that there would be residual effects on noise, vibration, and dust and acknowledge that the quality of the experience of hunting and trapping activities in areas near the mine would be reduced during construction and operations. These effects are summarized in the discussion of impacts to

SSN's Aboriginal right to fish and discussed in greater detail in Noise and Vibration (section 9), Air Quality (section 8), and Current Use of Lands and Resources for Traditional Purposes (section 18).

To mitigate SSN's concerns regarding Ajax's contribution to cumulative effects to cultural practices throughout SSN's asserted traditional territory, KAM has proposed to work with SSN to identify potential options for habitat compensation and offsetting options and to investigate the need for future studies on biodiversity and animal population trends in the region to determine the possible role of Ajax or other industrial activities in future conditions as they relate to harvested species. These opportunities could facilitate SSN's involvement in reclamation activities and identification of habitat rehabilitation locations for key species such as deer, moose, American badger, and sharp-tailed grouse. KAM has also proposed to support SSN in documenting past, present, and future land uses in the areas surrounding Ajax and in the larger traditional territory. SSN has communicated that these proposed mitigations are an inadequate colonial response that does not protect SSN's asserted traditional territory and resources.

In the SSN's Decision Package, SSN states that they are of the view that KAM's proposed mitigations are inadequate to mitigate the adverse impacts on SSN's hunting and trapping activities.

The EAO has proposed an EA Certificate condition that would require KAM to develop an SSN Access Management Plan in consultation with SSN. The plan would set out an approach to provide opportunities for SSN to engage in traditional land use practices on the mine site, as safety permits.

In consideration of the analysis of residual and cumulative effects to valued components, the information available from the SSN Assessment Process, the Agency's and EAO's consultation with SSN, SSN's engagement with KAM, KAM's proposed mitigations and the EAO's proposed EA Certificate Conditions, the Agency and EAO conclude that Ajax would result in moderate impacts on SSN's asserted Aboriginal right to hunt and trap.

24.4.2.4 *Mining and Minerals*

This section provides a summary of what the Agency and EAO understand to be SSN's asserted Aboriginal Interests related to mining and minerals. Please refer to the SSN Decision Package for a description told in SSN's voice.

SSN characterizes minerals as relatives and describes how they are found in the bodies, minds, and spirits of All My Relations. SSN links the spiritual, ceremonial, and cultural importance of the *Pípsell* area to its connection to the minerals in the underground Earth World. According to SSN, the importance of mining and minerals is illustrated through *stseptékwll* (oral histories), including *Tllisa7* and his brothers, *Stseptékwll* of Axana or Marten and Fisher, and the Trout Children *Stseptékwll*.

In the SSN Decision Package, SSN states that under Secwépemc law, SSN are the caretakers of minerals in the Stk'emlupsemc region while the Secwépemc Nation members collectively hold the rights to harvest minerals in Secwepemcúl'ecw founded on kinship ties. SSN asserts that they managed and harvested minerals from their territories prior to and after the arrival of Europeans in the late 1700s and early 1800s. SSN has described how members harvested gold and copper from a native copper deposit in the area of Copper Creek and Painted Rocks, located on the north shore of Kamloops Lake. SSN asserts that in the 1850s, and possibly earlier, Secwépemc people were also placer-mining gold at the mouth of Tranquille River and in other areas on the Fraser and Thompson Rivers and their tributaries. According to SSN, members also mined other minerals in the territory, including basalt, ochre, coal, sweat rocks, and jade, as well as mineral licks for deer and other animals.

SSN communicated that prior to and after European contact, their ancestors traded copper, gold, silver, quartz, nephrite and basalt, among other minerals. SSN has also described the importance of copper as a commodity traded with nations, including the Thompson, Lillooet, Okanagan, and Chilcotin.

Important cultural aspects of mining and minerals identified by SSN include trade, health, and teaching and transmission of knowledge. In the *Pípsell* Report, SSN describes trading copper, gold, silver, quartz, nephrite and basalt, among other minerals, with other Indigenous groups and communities. SSN considered copper as significant for Secwépemc survival as it was a way of life and a means of securing a moderate livelihood. SSN also describes a connection between the protection of minerals and mineral sources in *Secwepemcúl'ecw* to the health of its people and future generations. In terms of the intergenerational transmission of knowledge, SSN elders recalled their fathers showing them how to pan for gold and how to make a sluice box in order to wash gold. SSN also described how families and communities passed down known mining sites through generations and how this information was carefully managed to limit access to others.

SSN states in the Decision Package that Ajax would exclude its members from their traditional resources. According to SSN, Ajax would permanently remove metals and minerals from SSN's territory, including minerals from *Pípsell* that were used by SSN's ancestors, and that the "destruction and removal of this resource will result in a significant adverse effect to our people."[99]

Analysis and Conclusions of the Agency and EAO

This section addresses the mining of metals and minerals as a right asserted by SSN that is based on the specific practices, customs or traditions that were integral to the distinctive culture of SSN in the period prior to European arrival. The Agency and EAO included an assessment of impacts to SSN's asserted rights to mine metals and minerals in response to requests from SSN.

Potential impacts of Ajax on SSN's metal and minerals mining activities as they relate to Aboriginal title, such as how Ajax aligns with SSN's interests and aspirations over the area and the potential economic loss to SSN if Ajax proceeds, are discussed in section 24.4.2.6. Potential project related impacts on medicinal plants containing copper are discussed in section 24.4.2.2, All My Relations (Flora). Technical concerns raised by SSN related to mining for Ajax, such as concerns with the tailings storage facility design, and stability of the pit wall, among others, are discussed in Part B of this Report.

For the purposes of this assessment, the Agency and EAO consider the biophysical impacts of Ajax on SSN's mining activities to be the removal of metals and minerals within the open pit area by KAM through the extraction of concentrated ore. Consequently, these metals and minerals would no longer be available to SSN community members.

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[99] SSN (2017) SSN Joint Panel Recommendations Report for the KGHM Ajax Project at Pípsell , p. 52

The Agency and EAO understand that SSN's asserted right to mining metals and minerals has important site-specific, social, cultural, spiritual, and experiential components.

During the review of the EIS/Application, SSN identified numerous areas that were traditionally used by members for mining metals and minerals. SSN identified a deposit in the area of Copper Creek and Painted Rocks on the north shore of Kamloops Lake where community members traditionally mined gold and copper. According to SSN, Alfred Waddington's 1858 map of the gold fields shows "Indian Diggings" on the north side of Shuswap Lake. SSN also identified placer-mining gold sites at the mouth of Tranquille River, and in other areas on the Fraser and Thompson Rivers and their tributaries. Elders recalled their fathers panning and sluicing for gold in Deadman's Creek. Information provided by SSN does not describe any mining sites within the Ajax footprint.

SSN raised several concerns related to potential Ajax-related impacts on mining sites and access to metals and minerals within its asserted traditional territory. SSN has stated that Ajax would permanently remove minerals, resulting in a loss of the ability of all future generations to carry out mining practices. SSN has also communicated concerns regarding the mineral deposits below *Pipselletkwe*. SSN commented that there is outstanding information regarding the minerals in the area of *Pipsell* and SSN has not received confirmation that these deposits will remain untouched.

The Agency and EAO understand that SSN does not use the project area for current or traditional mining activities. The closest mining site identified by SSN at Tranquille River is more than 15 km from the project footprint. As a result, Ajax is not expected to disrupt access to SSN's mining activities.

During the EA, SSN identified several concerns related to potential project related impacts on the social, cultural, experiential, and spiritual aspects of mining activities. SSN has communicated that Ajax is also likely to result in permanent impacts on SSN's connection to minerals in the underground Earth World due to the removal of metals and minerals in the open pit. SSN also raised concerns that the permanent closure in the open pit area would adversely impact cultural aspects of SSN's mining activities, including trade of metals and minerals, teaching and knowledge transfer and holistic health.

In consideration of the information described above, the Agency and EAO conclude that Ajax would result in negligible impacts on SSN's asserted mining activities.

24.4.2.5 *Spiritual and Cultural*

This section provides a summary of what the Agency and EAO understand to be SSN's asserted Aboriginal rights related to their spiritual and cultural practices. Please refer to the SSN Decision Package for a description told in SSN's voice.

SSN asserts an Aboriginal right "to carry out a variety of cultural and spiritual customs, ceremonies, and traditions within SSN Territory, including spiritual ceremonies at or near Jacko Lake."[100] SSN calls the area that encompasses Jacko Lake and the surrounding environment *Pípsell* and describe it as a place that is integral to their culture and who they are as Secwépemc people, evidenced by the Trout Children *Stseptékwll*; particular geographic sites of significance, such as the hunting blind complex; and the cultural and ceremonial activities that occur in the area.

In the SSN Decision Package, SSN stated that if Ajax proceeds "the landscape that manifests our spiritual connection and resource use will be forever altered, severing our right to enjoy and use *Pípsell*, and severing our own and our descendants' ability to maintain our physical and spiritual connection to and within that landscape."[101]

SSN's conceptualization of Jacko Lake and the surrounding area as *Pípsell* derives from the Trout Children *Stseptékwll*, an oral narrative of great cultural importance to SSN. The Trout Children *Stseptékwll* is said by SSN to recount past human events on that landscape, including interactions with other types of beings in the under-water and water worlds, and the upper world of the sky country.

In addition to representing a historical account for SSN of the actions of their ancestors, the Trout Children *Stseptékwll* sets out Secwépemc laws, concepts, and teachings that contribute to protocols and guidance for living with each other, with non-Secwépemc people, with animals, and with the environment. For example, the concept of *X7ensq't* translates as "the land and sky will turn on you"[102] and is tied to particular places of power within SSN's asserted territory; *Pípsell* is one of those places. SSN's relationship with the land and how it is used is shaped by their need to respect *X7ensq't* and leads to a responsibility of *yecwemíñem* ("stewardship"), which is reinforced through the teachings in the Trout Children *Stseptékwll*. For SSN, contemporary environmental issues such as climate change and associated extreme weather events demonstrate the tangible consequences of disrespecting *X7ensq't*.

Today, SSN is able to identify geographic sites on the physical landscape of *Pípsell* that are referenced in the Trout Children *Stseptékwll*. SSN points to the waters of Jacko Lake, or *Pípselletkwe*, as the place where the trout children came from, and a specific spot in *Pípsell* as the location where a prayer tree (*Kwecúsem'*) that the grandson climbed into the sky world once stood.

SSN notes there are other important sites in *Pípsell* that demonstrate use of the area extending back thousands of years, such as the hunting blind complex. SSN has communicated that it is the only one of its kind documented in asserted Secwépemc territory. The hunting blind complex is marked by a number of petroforms and a large culturally modified tree in the hills north of Jacko Lake. SSN explains that the grasslands surrounding the hunting blind are an integral part of the complex as that landscape supported the ungulates that hunters would have directed into the hunting blind.

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[100] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 18.
[101] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 15.
[102] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 45.

That practice of hunting, as well as the practice of other landscape-based activities that occurred and in some cases continue today, further reinforces for SSN the cultural importance of *Pípsell*. As discussed in other sections of this Report, SSN shares that they conduct or have conducted in the past a variety of cultural activities in *Pípsell*, including hunting ungulates and grouse, trapping badger and other fur-bearing species, gathering plants for sustenance and ceremonial purposes, and carrying out their spring trout fishery at the outlet of Jacko Lake. SSN sees *Pípsell* as an ecologically valuable landscape for practicing these activities because it is a transitional zone from a grassland to Interior Douglas fir ecosystem and therefore high in biodiversity. SSN notes there are few intact transitional zones of this type remaining in their asserted traditional territory. Because of the richness of species and the ease of accessing the landscape and resources, SSN finds *Pípsell* to be an ideal area for the intergenerational transfer of knowledge and language through teaching SSN members how to carry out their cultural practices. Therefore, the cultural value of *Pípsell*, for SSN, is reciprocally bound to SSN's traditional landscape-based activities.

Some of the cultural practices of the Secwépemc that are currently, or have in the past been, undertaken at *Pípsell*, such as sweats and vision quests, have particularly strong spiritual and ceremonial significance. SSN notes they have found traces of fire pits from earlier ceremonial sweat lodges at *Pípsell*, recently re-established a men's sweat lodge near the southwest arm of Jacko Lake, and are in the process of building a women's sweat near the southeast arm. SSN has also communicated that there is at least one prayer tree located on the north side of Jacko Lake. SSN also describes specific customs and ceremonies that are performed at *Pípsell* because of the cultural and spiritual importance of the place. At certain sites, for example, SSN members make offerings and blacken their faces out of respect for *X7ensq't*. And as communicated through the Trout Children *Stseptékwll*, the landscape itself has a spiritual dimension for SSN that is intimately tied to a Secwépemc worldview and factors into the meaningfulness for SSN of the activities practiced at *Pípsell*.

Analysis and Conclusions of the Agency and EAO

The following is the Agency and EAO's analysis of the seriousness of the potential impacts of Ajax on SSN's asserted right to carry out cultural and spiritual customs, ceremonies, and traditions. The analysis is informed by the factors described in section 23.3, including the assessments of the following valued components:

- Surface Water Quality and Quantity (section 2);
- Groundwater Quality and Quantity (section 3);
- Fish and Fish Habitat (section 4);
- Vegetation (section 5);
- Wildlife (section 6);
- Air Quality (section 8);
- Noise and Vibration (section 9);
- Human Health (section 10);
- Current Use of Lands and Resources for Traditional Purposes (section 18); and
- Heritage (section 19).

During the EA, SSN identified a number of concerns regarding potential impacts of Ajax relating to the spiritual and cultural aspects of their asserted Aboriginal rights. The Agency and EAO understands SSN's key concerns to be:

- Ajax would irreparably affect *Pípsell*, the spiritual and cultural value of which is inextricably tied to the geographic location and to the Trout Children *Stseptékwll;*
- The cultural significance of the Trout Children *Stseptékwll* and related Secwépemc teachings, laws, and history (including *stseptékwll*) would be lost if *Pípsell* continues to be altered;
- The water world and water beings connected through aquifers in asserted Secwépemc territory and described in the Trout Children *Stseptékwll* would be negatively affected by changes to groundwater, water quality, and water quantity due to the construction of the open pit, general mining operations, alteration of Jacko Lake, and creation during reclamation of an artificial water body from flooding of the open pit;
- SSN people would avoid going to *Pípsell* due to perceived risks of health impacts from dust and contamination of resources, changes to the experience of being in the area from noise and alteration of the physical landscape, and a desire to minimize any further stressors on the wildlife and plants, which would affect their ability to express their culture through participating in practices and customs (such as ceremonies) and connecting with the power of place;
- Restrictions in access and effects from noise, light, or other artificial disturbances would inhibit SSN's ability to connect with their ancestors and *stseptékwll* at *Pípsell;*
- The infrastructure and operation of the mine would disrupt the power of place at *Pípsell* and by disrespecting *X7ensq't*, Ajax would cause the land and sky to turn on us[103];
- The trail from the prayer tree of the Trout Children *Stseptékwll* to Jacko Lake would be covered in tailings[104;]
- Construction of the open pit would result in the loss of the hunting blind complex, preventing it from ever being used again, and destroying a site that connects SSN to their ancestors and the natural world; and
- Activities practiced at *Pípsell* that connect SSN to their culture and spirituality, such as hunting and gathering plants, would need to be altered or ceased because of access restrictions, loss of plant and animal habitat, animals being scared off by mining operations, and a negative change in the experience of being on the land; such effects would also impact the transmission of knowledge and the Trout Children *Stseptékwll*, including the teachings it embodies.

A significant portion of the project area is currently held in fee simple and SSN access to the area to exercise cultural and spiritual practices is subject to KAM's permission. Despite previous impacts from earlier open pit mining and ranching activities, SSN considers *Pípsell* to be fundamentally intact and the area's historic ecological integrity could be restored.[105]

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[103] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 64.
[104] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 46.

The Agency and EAO considered the impacts of Ajax to ceremonial or cultural practices at *Pípsell*, including Jacko Lake, Jacko Creek, Goose Lake, Peterson Creek, the surrounding hills, and the hunting blind complex. Due to overprinting of project infrastructure, the hunting blind complex, north east arm of Jacko Lake, middle Peterson Creek, and Goose Lake would be permanently altered and no longer available for use. The remainder of Jacko Lake, Jacko Creek, upper Peterson Creek, the prayer tree, and lower Peterson Creek would not be impacted by project infrastructure and would remain accessible for SSN's cultural and ceremonial practices.

The Agency and EAO recognize there would be project effects causing sensory disturbances at *Pípsell,* particularly around Jacko Lake, due to the construction, operation, and decommissioning of Ajax. SSN has stated that these disturbances will impact the experience of using the area and discourage people from going there. Also, SSN has described how the ability to quietly enjoy the area is important for preserving their cultural heritage and the sensational presence of a large open pit mine cannot be mitigated.

At the request of the Agency, KAM assessed the effects of changes from Ajax to the environment that could affect SSN's cultural heritage or any structure, site or thing of historical, archaeological, paleontological, or architectural significance for SSN in relation to the Trout Children *Stseptékwll.* KAM determined that while Ajax would not substantially change SSN's asserted traditional territory, there would be substantial alteration of *Pípsell*, including areas around Jacko Lake known as places of rituals, offerings, prayers and root gathering.

The Agency and EAO did not consider alternative locations in this analysis, recognizing that cultural and spiritual activities can be site specific. SSN echoed this point and emphasized that *Pípsell* is a sacred place and the customs, ceremonies, and traditions cannot be transported elsewhere. For SSN, *Pípsell* is a place that exemplifies the interconnectedness of the landscape, all beings, humans across time, and their *stseptékwll.*

KAM proposed a number of measures related to biophysical, current use of lands and resources, and physical and cultural heritage effects that may also serve to mitigate impacts on SSN's asserted right to carry out spiritual and cultural practices, including:

- Collaboratively developing an Access Management Plan with SSN to facilitate continued access during operations to areas where it is safe for SSN members to practice ceremonial or cultural activities;
- Avoiding disturbance of significant sites where possible, such as rare plant habitat;
- Implementing a Heritage Management Plan and Chance Find Procedure, which may include relocating the hunting blind;
- Creating a Joint Mine Committee with SSN regarding the mitigation and monitoring activities required for all stages of Ajax; and

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[105] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 15.

- Developing an alternative road and parking lot to maintain access to Jacko Lake.

SSN maintains that regardless of the mitigation measures proposed by KAM, Ajax would adversely impact their ability to carry out their cultural and spiritual customs, ceremonies, and traditions at or near *Pípsell*. SSN states:

> *The Ajax proposal is completely inconsistent with maintaining Pípsell as a sacred area, as an area which continues to allow us to connect to our past and exercise our law, our governance, and our aboriginal rights… If the area surrounding Pípsell becomes a tailings storage facility, the Hunting Blind becomes an open mining pit, Peterson Creek is diverted, Jacko Lake is interfered with and forever altered, and Goose Lake becomes a tailings pond, the landscape that manifests our spiritual connection and resource use will be forever altered, severing our right to enjoy and use Pípsell, and severing our own and our descendants' ability to maintain our physical and spiritual connection to and within that landscape.*[106]

In materials presented to SSN on February 15, 2017, the Province proposed to work with SSN to develop initiatives to address potential residual effects of Ajax related to language and culture, health, family and community development, education, and employment and training (see Consultation by the Province in section 24.2.2 of this Report for additional detail). No accommodation agreements have been signed at the time of this Report and in the SSN Decision Package, SSN Joint Council rejected the accommodation proposed by the Province.[107]

In consideration of the analysis of residual and cumulative effects to valued components, the information available from the SSN Assessment Process, the Agency's and EAO's consultation with SSN, SSN's engagement with KAM, KAM's proposed mitigations and EAO's proposed EA Certificate conditions, Ajax, the Agency and EAO conclude that Ajax would result in serious impacts on SSN's asserted Aboriginal rights related to the practice of cultural and spiritual customs, ceremonies, and traditions at or near *Pípsell*.

24.4.2.6 *Aboriginal Title and Governance: Secwépemc Social and Political Fabric*

In *Tsilhqot'in Nation v. British Columbia*, 2014 SCC 44, the Supreme Court of Canada describes Aboriginal title as conferring ownership rights similar to those associated with fee simple, including the right to decide how the land will be used; the right of enjoyment and occupancy of the land; the right to possess the land; the right to the economic benefits of the land; and, the right to pro-actively use and manage the land.

When assessing potential impacts of project related activities on Aboriginal title claims, the Agency and EAO considered:

- Decision making;

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[106] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 15

[107] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell; SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax

- Use and occupation; and
- Economic benefits.

The assessment of impacts to Aboriginal title was informed by the relevant information presented in the preceding sections, including information regarding SSN's views of land stewardship. It is also informed by the Agency and EAO's assessment of effects to the valued components that informed the discussion of impacts to flora, fauna, fish and Aboriginal fisheries, spiritual and cultural practices, and mining and minerals. The Agency and EAO also considered the materials produced during the SSN Assessment Process, including the SSN Decision Package.

SSN's View of Aboriginal Title

This section provides a summary of what the Agency and EAO understand to be SSN's view of Aboriginal title. Please refer to the SSN Decision Package for a description in SSN's voice.

According to materials provided by SSN during the EA, Secwépemc title flows from the use and occupation of *Secwépemcúl'ecw* (the traditional land) prior to the British Crown's assertion of sovereignty in 1846, as well as from Secwépemc law as outlined in oral history. SSN has communicated that Secwépemc law provides the foundation for ownership and stewardship of SSN lands and resources. SSN has described the concept of Secwépemc title as the right to exclusive use and occupation of the land for a variety of purposes including stewardship and not necessarily restricted to practices, customs and traditions integral to their distinctive Secwépemc culture. According to SSN, they have a responsibility to protect, nurture and maintain *Pípsell* for future generations.

SSN asserts Aboriginal rights and title throughout their asserted traditional territory and has filed a claim for Aboriginal rights and title over an area that they identify as SSN traditional territory, which includes the Ajax site. SSN asserts that Ajax is well within the established and protected territory of the Secwépemc Nation, is on SSN's unceded traditional territory, and that the lands and resources in this area continue to be under traditional jurisdiction and ownership of SSN. SSN's Aboriginal title claim includes the Crown land and the fee simple land within the proposed project area. In consultation meetings with the Agency and EAO, and in materials submitted during the EA process, SSN also asserted that the Aboriginal title claim includes mineral rights.

Decision-Making

SSN has communicated that their governance system predates the arrival of European settlers and colonial governments. *Secwépemc stsq'ey'* (Secwépemc laws) provide the narrative foundation for ownership, stewardship, and land use planning of Secwépemc lands and resources. SSN has communicated that the oral histories associated with *Pípsell*, including the Trout Children Story, are foundational to Secwépemc laws. As described by SSN, SSN governance is communicated by way of deeds and markings of previous ancestors as manifested in place names, rock formations, rock paintings and stories.

SSN has asserted that the SSN people own, care for, and are responsible for the protection and management of the SSN territories. SSN has described how, according to Secwépemc law, the Secwépemc nations collectively hold their respective land and resources to the exclusion of outsiders. Furthermore, the Secwépemc system of collective ownership establishes a caretaker or stewardship role for groups over particular areas within *Secwépemcúl'ecw*. This role includes protecting the land from invasion by outsiders and, at times, the negotiation and implementation of treaties between nations. According to SSN, in their society, decision making over lands and resources occurs through the formal roles of community chieftainship.

SSN has described their role as stewards and caretakers of *Pípsell,* including the mine site. SSN has asserted the right to manage water, flora, fauna, fisheries, and all ecosystem resources, including metals and minerals, within their territory in a manner that protects the lands for the purpose of maintaining traditional cultural and other practices, their way of life, and the Secwépemc economy for current and future generations. SSN has communicated that under Secwépemc law, they have a unique responsibility and obligation to safeguard *Pípsell* and ensure a respectful relationship with the land that is in accordance with the Secwépemc laws, customs and traditions. For example, in documents shared with the Agency and EAO during the EA, SSN described the law of *X7ensq't* (the land and sky will turn on you). *X7ensq't* teaches of a relationship of reciprocal accountability between the land, sky, water, humans, and All Our Relations. This includes ensuring respect is shown for certain places on the land, such as *Pípsell,* that are imbued with spiritual power. If travellers in these places do not show respect, the powers will produce sudden violent changes in the weather.

SSN has continually stated their view that under Secwépemc laws, mineral tenure within SSN territory is held by SSN and the Secwépemc Nation, and more recently has iterated that access to mineral resources must only be permitted following completion of the SSN Assessment Process established for the review of Ajax. SSN has also stated that the EA and other provincial and federal decisions must be made in a manner consistent with SSN's laws, customs, and traditions, and with the full and informed consent of SSN.

SSN has also asserted their continuing right to determine future land use for *Pípsell,* including the project area and its surrounding areas. They further assert the right to self-govern and to determine land use objectives for *Pípsell* and the surrounding area using their traditional governance model. SSN stated that the land use objectives for *Pípsell* and the surrounding areas are based on historical and traditional land uses in the area and they must be consistent with the principle of a culturally enriched sustainable land use. SSN has told the Agency and EAO that all activities and developments on SSN territory must be consistent with SSN laws. As a result of the SSN Assessment Process, on March 4, 2017, the SSN Joint Council identified the following overarching land use objective for *Pípsell* and the surrounding area:

Pípsell is a cultural keystone area which must be preserved in a state consistent with the traditional importance of the site to the Secwépemc people. Pípsell must only be used in ways which preserve and sustain the area, and which allow for the culture of the Secwépemc people to be exercised and maintained.[108]

SSN has also noted that the SSN Assessment Process, and the resulting Decision of the SSN Joint Council, indicate that it does not give its free, prior and informed consent to the development of the land and resources at *Pípsell* for the purposes of Ajax. SSN has stated that through the process and decision, they are asserting the right to determine how the lands and resources will be used now and in the future and that the process itself is an expression of continuing governance.

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[108] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell

Potential Impacts and Proposed Mitigations/Accommodations

During the EA, SSN raised a number of concerns regarding how Ajax could affect their decision-making / governance of the area overlapped by the mine site. The Agency and EAO understand SSN's key concerns to be:

- Ajax conflicts with SSN's overarching land use objective for *Pípsell* and the surrounding area and would prevent that objective from being fulfilled;
- Adverse impacts to SSN's ability to regain governing jurisdiction over the lands, including deciding how the lands are used;
- *X7ensq't* would be adversely impacted by the mine-related disturbances such as blasting, humming of machinery, movement of trucks and heavy equipment, vibration on the ground, bright lights that block out the stars at night and the other relations that are absent from the area, plants that are clear cut, animals that have fled, and the fish that are threatened. *X7ensq't* at *Pípsell* is adversely affected by a disturbance of its flow and feel and of its contentedness and in it being so disturbed and disrupted, so too does it lose its power to connect all Secwépemc to the water, the land and the sky. SSN believes that Ajax would destroy SSN's connection to their ancestors if they lose the connection to the *X7ensq't* at *Pípsell;*[109] and
- Reduce SSN's ability, now and in the future, to meet their cultural and spiritual obligations as stewards of the proposed project area, reduce the Secwépemc ability and authority to uphold Secwépemc *stsq'ey'* and to fulfill their obligations to *X7ensq't.*

SSN has stated that severe disruption to the landscape, the water, the air, and All Our Relations, which fundamentally change the character of the place, is not consistent with what they view as a sustainable land use. In the SSN Decision Package, SSN states that they are of the view that Ajax would "interfere with and adversely impact our ability to exercise good stewardship and manage wildlife and wildlife habitat in *Secwepemcúlecw* for the health of all our relations and for future generations." [110] And that "the presence of the Project would adversely impact our way of life and self-government directed and managing, sustaining and revitalizing of *Pípsell* and the surrounding grasslands." [111] And lastly, that *X7ensq't* at *Pípsell* would be "adversely affected by a disturbance of its flow and feel and of its contentedness and in it being so disturbed and disrupted, so too does it lose its power to connect all Secwépemc to the water, the land and the sky. The Project will destroy our connection to our ancestors when we lose the connection to the X7ensq't at *Pípsell*." [112]

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[109] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pípsell*

[110] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pípsell*, p. 45

[111] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pípsell*, p. 45

[112] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pípsell*, 2017 p. 46

During the EA, the Agency and EAO worked with SSN to develop and implement federal and provincial approaches to engagement that have the objectives of supporting informed decision making by all parties in their respective assessment processes and ensuring that SSN's input is adequately considered in the federal and provincial decision-making processes about Ajax. Section 24.2.1 of this Report describes Consultation by the Agency, while section 24.2.2 describes Consultation by the Province and provides more detail on the Ajax EA Collaboration Plan.

From community sessions and working-level discussions through to leadership meetings, the Agency and EAO worked with SSN to understand how Ajax could potentially impact SSN's interests and what measures could avoid, mitigate, or accommodate those impacts. The Agency and EAO also received information generated through SSN's Assessment Process, which was considered in the assessment of effects to valued components, the assessment of impacts to SSN's Aboriginal Interests, and will be provided to the federal and provincial decision-makers to help inform the EA decisions.

If Ajax receives an EA certificate and proceeds to permitting, the Province has committed to continuing a collaborative approach with SSN by entering into an Ajax Permitting Collaboration Agreement that would also be a part of the larger Ajax Government to Government Framework. Federally, if Ajax moves to the regulatory approval phase, the federal Crown would consult SSN as appropriate prior to taking regulatory decisions.

KAM owns a large portion of the mine site as fee simple private lands. Currently, KAM and other entities hold mineral claims throughout the mine site. In pursuing its interest in developing a mine at this site, KAM reports that, prior to the commencement of the EA and through the EA process, it sought to involve SSN in planning and decision making regarding the proposed project area. Section 24.2.3 of this Report provides additional details.

In order to begin construction and production, KAM would require numerous authorizations on both the Crown land and the fee simple land, including a mineral lease. KAM has committed to provide additional capacity funding to involve SSN in subsequent permitting and pre-mine joint development. This includes base funding for SSN participation in permitting processes, funding to participate in the development of a joint KAM-SSN mine committee and sub-committees, and support for SSN to play an active role in the mine committee. KAM advised that this joint committee would employ SSN's *Walking on Two Legs* principles to address pre-mine through to post-mine items and issues, and could potentially include a multitude of sub-committees including a human resources sub-committee, health and language sub-committee, cultural heritage sub-committee, and technical sub-committee.

Should Ajax proceed, KAM has committed to support SSN in their stewardship of water and other environmental resources through involving SSN in decisions about the design and ongoing review of existing water quality programs and plans. In regard to ongoing land management at the mine site, KAM has proposed a number of initiatives to support SSN involvement in decision-making including establishing a committee with SSN to facilitate the implementation of mitigations and the monitoring of effects/impacts, and to enhance SSN's role in various aspects of decision making throughout the life of Ajax. KAM has committed to implementing a collaborative approach to reclamation with SSN including supporting ongoing research and incorporating SSN input into identification and siting of plants during re-vegetation as well as the identification of habitat rehabilitation locations for key wildlife species. KAM has also committed to implementing a site disturbance policy, which includes opportunity for SSN to participate in on site disturbance planning including advance notice regarding formal submissions to regulators and inviting SSN to visit the site during site disturbances. KAM would also work with SSN to document past, present and future land uses in the areas surrounding Ajax and in the broader traditional territory, which KAM believes would support SSN involvement in future land use planning considerations for reclamation and closure. The Agency and EAO recognize that SSN is of the view that KAM's proposed mitigations are inadequate.

The EAO has proposed an EA Certificate condition that would require KAM to develop an Indigenous engagement plan in consultation with SSN. The plan would be required to set out an approach to involving SSN and other Indigenous groups in timely and appropriate information sharing, as well as approaches to receive and address concerns and issues raised by Indigenous groups. Additionally, EAO has proposed requirements in EA Certificate conditions for KAM to consult with SSN regarding all management plans.

To accommodate potential impacts to SSN rights and title that are outside the scope of the EA, the Province proposed to undertake a pilot collaborative stewardship initiative with the SSN in the Thompson River watershed (see Consultation by the Province in section 24.2.2). No accommodation agreements have been signed at the time of this report and in the SSN Decision Package, SSN Joint Council rejected the accommodation proposed by the Province.

Summary of the Agency and EAO Analysis on Impacts to the Decision-making Component of Aboriginal Title

The Agency and EAO recognize that KAM made efforts throughout the EA to engage SSN that were formalized in agreements with SSN regarding process, research, and capacity funding. Should Ajax proceed, KAM has committed to continue to engage SSN, for example, by inviting SSN to be involved in permitting and monitoring committees. The Province of BC and SSN have also entered into an Ajax Government to Government Framework Agreement setting out collaboration frameworks for any subsequent permitting processes for Ajax. The EAO has proposed an EA Certificate condition requiring that KAM develop and implement an Indigenous engagement plan. Furthermore, the Province has offered an accommodation package to SSN that would include stewardship initiatives. Involvement in the KAM - and provincially-led initiatives may afford SSN opportunities to contribute to aspects of decision-making over land use and development of the project area and in SSN's broader traditional territory.

The Agency and EAO understand that the SSN Joint Council, which is a traditional governance body, has formally opposed Ajax because they see it as fundamentally in opposition to SSN's overarching land use objective for *Pípsell*, a sacred area for SSN that is intrinsically linked to their laws and oral histories. The Agency also understands that SSN believes that if Ajax were to proceed as proposed, there are no measures that could accommodate project impacts on the decision-making and governance aspects of their asserted Aboriginal title.

Use and Occupation

SSN has communicated that in addition to the spiritual and cultural values associated with *Pípsell*, the area is important to SSN as it contains medicines, foods, and animals. Historically, the proposed mine site and surrounding area was used for hunting, trapping, gathering of plants and for cultural and spiritual purposes. SSN historically fished at Jacko Lake and the Peterson Creek outlet and inlet were the sites of early spring fisheries for trout. In addition to the hunting blind complex, SSN has communicated that the mine site likely also includes undocumented camping sites.

According to SSN, hunting, trapping, fishing, plant gathering, spiritual practices and the associated teaching and intergenerational transmission of knowledge continue at the mine site and in the surrounding area today, although private property, fencing (some dating back to 1878), ranching and past mining activities at the site have limited SSN's access and ability to use the area. As described in detail in the previous sections, due to cultural revitalization efforts by SSN and an agreement with KAM that facilitates SSN access to KAM-owned private lands, there has been a recent increase in the traditional cultural practices at *Pípsell*.

Potential Impacts and Proposed Mitigations/Accommodations

During the EA, SSN raised a number of concerns regarding how Ajax could affect their use and occupation of the area overlapped by the mine site. The preceding assessments of impacts to rights discuss many of these concerns in greater detail. The Agency and EAO understand SSN's key concerns to be:

- Biophysical impacts and disturbances that could reduce SSN's ability to practice traditional uses;
- Loss of access to areas that are of importance for cultural practices;
- Development of the mine site would prevent SSN from being able to carry out the activities they believe are consistent with SSN's land use objective developed for *Pípsell*, such as designation of the area as a cultural heritage site, educational uses, non-destructive resource uses, cultural uses, and restorative purposes that allow for the lands and resources to be revitalized and restored to a historical state prior to any non-Indigenous use;
- Destruction of the hunting blind complex, an important cultural site, demonstration tool and teaching aid for knowledge transfer; and
- Project impacts (e.g., visual, noise, dust, presence of non-SSN), including experiential changes, to the area could reduce the likelihood that these areas would continue to be used by SSN members, thus destroying connection to their ancestors. SSN has stated that members go to *Pípsell* as a place that anchors them to past experiences and to the land. For there to be a spiritual connection to the Sky World, there must be a calm and serene environment so that they may feel the flow and power of the place and be at ease in order to open and connect with their ancestors and become grounded with the water, the land and the air.

As described in the preceding subsections of section 24.4, Ajax would impact SSN's use of the mine site and adjacent areas, including impacts to SSN's asserted Aboriginal rights to fish, hunt and trap, gather plants, and conduct spiritual and cultural practices.

KAM currently owns 87% of the mine site as fee simple private property. The remaining 13% is Crown land that is distributed throughout the site in ten different parcels of varying size, each of which is surround by private land. The mine site currently includes 225 hectares of previous mining infrastructure including rock storage facilities and 44.4 hectares of historical open pits. Although there have been site disturbances, a loss of plant and animal biodiversity, and the introduction of noxious weeds from past activities including ranching and mining, SSN has communicated that the current condition of the mine site (both fee simple and Crown land) is largely compatible with their traditional uses and that they are of the view that the area's historical ecological integrity could be restored.

SSN's access to the mine site would be restricted. Additionally, SSN's access would be restricted to the immediately adjacent areas for health and safety reasons (e.g. blasting exclusion zone). There is some uncertainty regarding the total size and location of the areas that would be affected by access restrictions. KAM

has communicated that the access-restricted areas may be generally delineated by the proposed 2250 hectares Mines Act Permit Area, although they cannot confirm this at this time. Regardless of the precise location of the boundary, SSN would lose existing access to approximately
220 hectares of Crown land consisting of 10 individual parcels that are currently only accessible via KAM's privately owned and fenced lands. Safety zones around the open pit during blasting periods would also include parts of Jacko Lake and the outlet of Peterson Creek, where SSN has a spring trout fishery. Roads within the mine site would be closed, affecting access to certain areas, including portions of Goose Lake Road. Access and use restrictions are expected to persist for the full life of the mine, from the commencement of construction through to the completion of active closure and reclamation activities.

In order to mitigate impacts to land users, including SSN members, in proximity to the Ajax boundary during construction and operations, KAM has committed to a number of measures to reduce the changes to the area. These include noise, vibration, and dust management plans, and avoiding construction activities within Jacko Lake during spring (to accommodate SSN's spring trout fishery). KAM has also committed to informing SSN when blasting would occur and demarcating blasting areas.

As Ajax was described in KAM's EIS/Application, the project would have resulted in the complete loss of the SSN fishing station at the Peterson Creek outlet. In response to concerns from SSN and other members of the working group, KAM redesigned Ajax and the Peterson Creek diversion to avoid the fishing station.

The revised Conceptual Fish Habitat and Fishery Offsetting Plan (see Fish and Aboriginal Fisheries in section 24.4.2.1 of this Report), also includes habitat enhancements to upper and lower Peterson Creek, thus supporting the SSN spring trout fishery at these locations. To address SSN's concerns about effects to the Jacko Lake fishery, KAM has committed to work with SSN to identify other potential candidate options for habitat compensation and offsetting options within SSN's asserted traditional territory.

KAM has proposed ways to maintain some site characteristics that are valued by SSN. This includes designing roads and transmission lines to avoid and minimize impacts on water bodies and areas of rare plant occurrences, and washing vehicles to reduce spread of invasive plants. KAM also committed to undertake a collaborative approach to reclamation with SSN including providing funding for ongoing reclamation research and incorporating SSN's input into the identification and siting of plants for re-vegetation. If Ajax receives an EA Certificate, KAM has said it would collaborate with SSN to prepare the Mine Closure and Reclamation Plan, which must be updated every five years at minimum. The Agency and EAO note, however, that there is a high level of uncertainty regarding whether or not the mine site could be reclaimed to a level that is able to support SSN traditional practices.

As discussed above, access to the lands in the open pit would be permanently lost, including 70 hectares of Crown land. KAM has proposed to work with SSN to develop an Access Management Plan and to do the following:

- Provide continued use of areas such as Jacko Lake and the surrounding lands for a variety of uses;
- Minimize changes in access to, or use of, preferred ceremonial or other cultural use sites;
- Modify the Jacko Lake access road and parking lot to maintain current conditions of free access to the lake (for SSN and for members of the public);
- Facilitate access to the mine site for SSN to conduct traditional use activities and conduct offerings, when possible;

- Allow SSN to participate in accessing, harvesting, and/or documenting resources of cultural or ceremonial value prior to the project footprint disturbance (and during project execution); and
- Support SSN to participate in accessing areas of cultural value prior to the project footprint disturbance.

KAM stated that as reclamation activities conclude, it is committed to providing access to the site on an incremental basis at a level of access similar to that which they currently provide. SSN access could be provided for activities such as plant harvesting and hunting if it was deemed safe and closure objectives required by the *Mines Act* and other regulations were achieved. The Agency and EAO note that there is uncertainty regarding the timing and degree of the site to which SSN would gain access.

In the SSN Decision Package, SSN communicated that KAM's proposed mitigations are inadequate to address impacts to their use and occupancy of the area.[113] The Agency and EAO also note that SSN is opposed to the development of an alternative access route to Jacko Lake because of the potential impacts to areas where cultural and spiritual practices are undertaken due to an increase the presence of non-SSN members in those areas.

The EAO has proposed an EA Certificate condition that would require KAM to develop an SSN Access Management Plan in consultation with SSN. The plan would set out an approach to provide opportunities for SSN to engage in traditional land use practices on the site, as safety permits.

To address potential residual effects of Ajax, and to ensure there are benefits flowing to the potentially impacted SSN communities, the Province offered to transfer to the SSN Crown land(s) with a value of up to $8 million. No accommodation agreements have been signed at the time of this Report, and in the SSN Decision Package, SSN Joint Council rejected the accommodation proposed by the Province.[114]

Summary of the Agency and EAO's Analysis on Impacts to the Use and Occupation Component of Aboriginal Title

The Agency and EAO understand that SSN's access to and use of lands and resources in their asserted traditional territory – including *Pípsell* – has long been impeded by private property and land development, such as ranching and historic mining. In the Decision of the SSN Joint Council, SSN states the following regarding private property and their assertion of Aboriginal title over *Pípsell*:

> *This assertion of title is made notwithstanding the fact that Secwépemc people were dispossessed of their lands through various Colonial laws and expropriations which allowed non-Indigenous people to hold our lands in fee simple, including the lands at Pípsell. We have never consented to the transfer of*

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[113] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 64

[114] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at *Pípsell*; SSN (2017) Decision of the SSN Joint council on the Proposed KGHM Ajax

> *our lands to private land holders. Our aboriginal title to the lands is a pre-existing title, an interest which underlies and pre-exists Crown title, and which has never been surrendered or extinguished.*[115]

The Agency and EAO acknowledge that KAM has facilitated access to its property in recent years for SSN to conduct traditional practices, such as the spring trout fishery at the outlet of Jacko Lake. KAM has committed to continue to allow some access – where safe and practicable – during the life of the mine. KAM's proposed measures to provide SSN members with access to parts of the mine site could allow SSN to continue to use some of the lands and resources at *Pípsell.* Development of Ajax would further inhibit SSN's ability to use these areas into the future, for at least the life of the mine. Future SSN use of the site may depend on the success of reclamation efforts following closure of the mine and on the ownership of the lands at that time.

The Agency and EAO recognize that SSN's interest in accessing, using, and managing the lands and resources at *Pípsell* goes beyond carrying out traditional practices, such as fishing, hunting, and gathering, and extends to managing and using *Pípsell* for other activities that are consistent with their overarching land use objective. According to SSN, these activities (identified above) would be sustainable into the future and would not fundamentally change the character of the place. The long-term and, in some cases, permanent changes to the land from Ajax itself could adversely impact SSN's ability to use the land in the future for such activities.

Economic Benefits

SSN has described their economy as a hybrid that includes a market economy and an aboriginal or customary economy associated with cultural continuities and subsistence. SSN has asserted the right to benefit from resources. In addition to the asserted harvesting rights (hunting, trapping, fishing, and plant gathering) described in greater detail above, SSN asserts an Aboriginal right to use, manage and benefit from minerals within their asserted traditional territory. SSN has communicated that, according to Secwépemc law, their caretaker role also includes stewardship of minerals. Similarly, SSN has communicated that their belief system includes a right and responsibility to All My Relations who are connected to, and who rely on, the minerals in *Secewépemculecw.*

In the SSN Decision Package, SSN states that they are of the view that Ajax would "have significant adverse effects on our SSN economy and our rights to determine the uses to which the resources in our Territory are put. Decisions relating to resource use in our territory, and relating to the development of our economy are fundamental governance decisions. Adverse impacts on our economy and resources in our territory result in a significant impact on our way of life and right to self- governance." [116]

According to information shared by SSN during the EA, members traditionally used the mine site and surrounding area for traditional harvesting purposes and continue to rely heavily on traditional foods harvested throughout their territory as a part of their seasonal round. However, as described above, access to the private and Crown lands at the mine site is limited. Although SSN has indicated that they have used this area continuously with some limitations, access to certain areas increased in 2015, facilitated in part by an agreement with KAM, the fee simple holder. The preceding discussions of impacts to SSN's asserted fishing, plant gathering, hunting and trapping, and metal mining rights, describe SSN's use of the mine site in more detail (sections 24.4.2.1 to 24.4.2.4).

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[115] SSN (2017) Decision of the SSN Joint Council on the Proposed KGHM Ajax Project

[116] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell, p. 40

In information provided during the EA, SSN has also indicated that one member owns a guide outfitting business that could be impacted by the mine. However, the Agency and EAO note that there is limited information about guiding activities in the vicinity of Ajax. As the vast majority of the area surrounding Ajax is private property, and hunting on private land is subject to the permission of the land owner, it is not anticipated that guide outfitting activities would occur near Ajax during the life of the mine.

Potential Impacts and Proposed Mitigations/Accommodations

During the EA, SSN raised a number of concerns regarding how Ajax could affect SSN's economies and potential to benefit economically from *Pípsell*. The Agency and EAO understand SSN's key concerns to be:

- Reduced ability of SSN to benefit from traditional and contemporary economic activities in both the area where active mining would be occurring (including tailings impoundments and equipment storage areas) and the surrounding area;
- Adverse effects to the seasonal round;
- Reduced ability for SSN members to choose to live off the land;
- Reduced ability for SSN members to share resources within the Secwépemc Nation, which the SSN has stated is of vital importance to their Aboriginal economy;
- Reduced future economic potential for *Pípsell*, including the mine site; and
- The permanent removal of copper and gold, a traditional income stream for SSN's Aboriginal economy.

During construction, operations, and reclamation phases of the mine, traditional economic activities currently practiced in the area, such as hunting, trapping, plant gathering, and fishing, would be impacted. Changes to access and changes to the environment from Ajax could affect SSN's participation in harvesting activities and their ability to obtain traditional foods in the project area. Additionally, members may choose to avoid the general area due to disturbances, perceptions of risk of contamination or concerns about the wellbeing of the fish, plants and animals.

As some areas of Ajax (including a portion of the Crown land) would not be restorable to a condition suitable for activities such as fishing, hunting, trapping, and plant gathering, potential for losses in availability of resources within these areas could be permanent. As discussed above, the existing access restrictions/limitations associated with the fee simple status of the majority of the project area and adjacent area, has implications on SSN's continued use of the area for traditional harvesting activities and other economic aspirations, even if Ajax were not to proceed.

SSN has expressed concern that Ajax would limit the potential for SSN economic activities such as tourism and guide outfitting. The Agency and EAO note that the potential for these activities is currently limited as the majority of the lands are previously disturbed and are private land or inaccessible due to location. If Ajax were to proceed, the opportunity to conduct these types of activities in the future would be severely limited because of long-term and permanent changes to the landscape.

With respect to the economic aspect of extracting the minerals from this area, Ajax would remove large quantities of these minerals from *Pípsell*. According to section 3 of KAM's EIS/Application, the total proven and probable mineral reserves at Ajax are 503 Mt, including approximately 2.960 Mlbs of copper and 2750 K oz of gold. SSN has stated that the removal of these resources is the permanent removal of a traditional income stream for their Aboriginal economy.[117] At SSN's request, KAM has also committed to providing SSN with regular updates regarding the amount of mineral resources removed from the area.

At SSN's request, KAM has also committed to providing SSN with regular updates regarding the amount of mineral resources removed from the area.

To reduce economic impacts to SSN, KAM has proposed a number of mitigation strategies focused on training, job creation, and business development. KAM has highlighted that Ajax would create long-term careers for SSN members. Towards this end, KAM has committed to working with SSN to develop a First Nations human resources development plan for all phases of Ajax. The plan would provide First Nations members with opportunities to successfully integrate into the workplace through First Nations-specific recruitment and training education strategies. KAM has also committed to develop a strategy to provide skills training to SSN members and to create a labour force database of SSN members that can be used to help identify appropriate training programs, as well as a number of other community initiatives to increase education and training of SSN members. KAM has stated that efforts would be put in place to maximize recruitment of First Nations candidates, in collaboration with the First Nations liaison, with a goal of securing 30% of the employment at the mine from SSN. In the SSN Decision Package, SSN communicated that KAM's proposed mitigations related to employment and business development are inadequate to address impacts to SSN.

KAM also indicated that it has been pursuing a Mine Development Agreement with SSN since 2014. This agreement, if signed, would provide economic and other benefits to SSN that may help to address adverse impacts of Ajax on SSN's interests. SSN raised concerns that these benefits are overstated and that not all SSN members are guaranteed to receive all of these benefits. Additionally, SSN Joint Council's Decision Package rejected accommodations proposed by KAM as insufficient.

The EAO has proposed an EA Certificate condition that would require KAM to monitor and report on Aboriginal training, employment, and procurement opportunities, including local and regional skills and business capacity. The EAO has also proposed a condition that would require KAM to develop an Aboriginal engagement plan in consultation with SSN. The plan would be required to set out an approach to involving SSN in the information sharing and opportunities for Indigenous groups to participate in pre-construction, construction, and post-construction monitoring. Additionally, the EAO has proposed requirements in EA Certificate conditions for KAM to consult SSN regarding all management plans.

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[117] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pipsell

As described in Consultation by the Province (section 24.2.2 i), the Province has also offered SSN measures to address SSN's interests related to economic development. No accommodation agreements have been signed at the time of this Report, and in the SSN Decision Package, SSN Joint Council rejected the accommodation proposed by the Province.[118]

Summary of the Agency and EAO's Analysis on Impacts to the Economic Component of Aboriginal Title

The Agency and EAO recognize that SSN has the opportunity to benefit economically from the development of Ajax due to agreements and offers that have been presented to SSN by KAM and the Province of BC. The Agency and EAO understand that SSN has declined these offers to-date.

The Agency and EAO are of the opinion that Ajax is not likely to significantly affect current economic benefits that SSN might accrue from *Pípsell*, recognizing that SSN has long been largely unable to use the area for economic gain. Long-term and permanent changes to the landscape from Ajax, and the associated effects on the types of land-based practices that contribute to SSN's Aboriginal economy, could adversely impact SSN's future ability to pursue economic benefits that align with SSN's stated land use objective for *Pípsell*.

The Agency and EAO's Conclusions on Impacts to Aboriginal Title

In the preceding discussion, the Agency and EAO have considered factors, particularly SSN's perspectives, relevant to assessing impacts of Ajax on SSN's asserted Aboriginal title. The Agency and EAO acknowledge that it is SSN's view that Ajax would have serious impacts on Aboriginal title and that SSN opposes Ajax.

The Agency and EAO are of the view that development of Ajax would result in adverse impacts to SSN's asserted Aboriginal title. The Agency and EAO recognize that SSN has brought a claim before the courts seeking a declaration of Aboriginal title over an area that is largely held as private fee simple land and includes the mine site. It is unclear how a court will address the current private land ownership in relation to SSN's claim seeking a declaration of Aboriginal title to this area. Consequently, there is uncertainty in estimating the level of seriousness of impacts on SSN's future ability to apply its traditional governance in this area, to use the area for traditional purposes, and to obtain economic benefits from the area. Regardless of this uncertainty, the Agency and EAO consider that the mitigation and accommodation measures identified to date, including proposals made by both KAM and the Province, may help to address the residual impacts of Ajax on aspects of SSN's asserted Aboriginal title.

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[118] SSN (2017) SSN Panel Recommendations Report for the KGHM Ajax Project at Pípsell; SSN (2017) Decision of the SSN Joint council on the Proposed KGHM Ajax

25 Ashcroft Indian Band

Ashcroft Indian Band (Ashcroft) is a part of the Nlaka'pamux Nation, whose asserted traditional territory covers the project site. Within the Nlaka'pamux Nation, Ashcroft asserts a traditional territory that extends east beyond Nicola Lake, north towards Hihium Lake, west to the Thompson River, and south to the United States border. Ashcroft holds four reserves (Cheetsum's Farm 1, 105 Mile Post 2, McLean's Lake 3, and Ashcroft 4) situated in the Thompson River watershed. As of May 2017, Ashcroft had a registered population of 278, with an on-reserve population of 72.

25.1 AGENCY AND EAO DEPTH OF CONSULTATION

The EAO conducted a preliminary assessment of the Nlaka'pamux Nation's claim for Aboriginal rights and title over the project area and stated that the Nlaka'pamux Nation has a weak *prima facie* claim for Aboriginal rights and title since this area is indicated by available ethnographers to be outside of their historical territory at time of contact and 1846 and there is no specific information of historic Nlaka'pamux use of this area. The available information indicates that the historical Nlaka'pamux territory boundary was a distance to the south of the project area. The EAO understands it is possible the Nlaka'pamux may have travelled into this area to trade at Kamloops, but that any such use would have likely been subject to the permission of the Kamloops division of the Secwepemc.

Given the nature and location of Ajax, and the potential impacts of Ajax on Ashcroft's Aboriginal Interests, the EAO is of the view that the legal duty to consult Ashcroft lies at the low end of the *Haida* consultation spectrum. In recognition of Ashcroft's interest in potential impacts outside of the project footprint, the EAO issued a section 11 order identifying Ashcroft as one of the Indigenous groups to be consulted.

The Agency and federal responsible authorities determined that it was appropriate to consult Ashcroft at a moderate depth of consultation. This assessment was based in part on Ashcroft being party to a legal protective writ, on behalf of the Nlaka'pamux Nation, that asserts existing Aboriginal title to a territory which includes the Ajax site. Ashcroft also expressed concerns about the impacts of Ajax on their asserted Aboriginal rights and indicated that they were interested in participating in the EA and consultation process.

On July 7, 2011, the Agency sent Ashcroft a letter with a proposed consultation approach consistent with a moderate depth of consultation, along with an invitation to apply for funding, and invited comment and feedback on it. The Agency did not receive comments from Ashcroft on the proposed consultation approach.

25.2 SUMMARY OF CONSULTATION

25.2.1 AGENCY AND EAO LED CONSULTATION

The following section describes the actions undertaken by the Agency and EAO in order to fulfil the Crown's duty to consult with Ashcroft. Section 25.2.2 describes the procedural aspects of consultation undertaken by KAM, at the Agency and EAO's direction, on behalf of the Crown.

As part of an EA, the Agency and EAO provide funding to Indigenous groups to assist with costs associated with their participation in the process. To support Ashcroft's involvement in the process, the EAO provided $5,000 in capacity funding to Ashcroft during the pre-EIS/Application phase and $10,000 in capacity funding during the

EIS/Application Review phase. The Agency allocated $24,800 to Ashcroft through the Participant Funding Program.

The Agency and EAO invited Ashcroft to review and comment on key documents related to the EA, including the Project Description, draft EISG/AIR, KAM's EIS/Application, and this Report. The Agency, EAO, and Ashcroft also engaged in ongoing correspondence, phone calls and emails throughout the EA process.

In April 2011, the EAO issued a section 11 order, establishing the working group, which is co-chaired by the Agency. The working group included representatives of Ashcroft. Ashcroft participated in a working group meeting in June 2014. The Agency and EAO invited Ashcroft to participate in other working group meetings, although Ashcroft did not attend. As part of the working group, the Agency and EAO provided Ashcroft with opportunities to review and comment, verbally and in writing, on the selection of valued components for the effects assessment, design of the baseline study programs, environmental and socio-economic studies, and any issues and information requirements related to the EIS/Application. Any comments provided were considered in the development of valued components, the EISG/AIR, and other aspects of the EIS/Application.

The EAO provided information on the EA process and sought input from Ashcroft on how they could be involved, in a letter dated September 20, 2011. The letter also requested comment on the draft section 11 order which outlined First Nation consultation opportunities. The EAO did not receive comments from Ashcroft, and the section 11 order was issued on January 11, 2012. The section 11 order identified Ashcroft as a "Working Group First Nation" to be consulted through activities consistent with consultation at the middle of the *Haida* spectrum, including opportunities to participate in working group activities.

On April 26, 2012, Ashcroft wrote the EAO to outline their concerns regarding the Ajax EA. These concerns primarily focused on Ashcroft's ability to meaningfully participate in the EA process and the adequacy of the EAO's assessment of Ashcroft's strength of claim within the project area. Concerns expressed by Ashcroft related to strength of claim were in response to a February 7, 2012 meeting at which the EAO informed Ashcroft that the Province considered Ashcroft to have a low *prima facie* strength of claim over the project area. Ashcroft's letter also identified issues with the draft EISG/AIR, including:

- Ashcroft participation in the EA process;
- Incorporation of traditional ecological knowledge;
- Effects on water resources and plant health;
- Ashcroft involvement in mine auditing; and
- Ashcroft traditional territory and land use.

The EAO's response to Ashcroft's letter on July 6, 2012 provided further clarification of the EA process and consultation approach. Ashcroft was provided opportunities to submit comments during the screening of the EIS/Application, to participate in EIS/Application Review, and to meet with the EAO.

In July and August of 2012, representatives of Ashcroft met with the EAO to discuss Ajax and identify specific Ashcroft concerns regarding the EA process, consultation approach, traditional use studies, cumulative effects, and strength of claim assessment.

On November 22, 2012, the EAO provided Ashcroft with the results of the initial strength of claim assessment and an opportunity to submit additional information regarding traditional use of the project area. From this initial assessment, the EAO determined that the duty to consult Ashcroft on Ajax lies at the low end of the *Haida* consultation spectrum.

Ashcroft wrote a letter to the Agency and EAO on October 24, 2014, which stated that Ashcroft supports Ajax and that they had been adequately consulted and accommodated with respect to potential impacts on their Aboriginal rights and title.

25.2.2 KAM LED CONSULTATION

During an EA, the EAO delegates some procedural aspects of Aboriginal consultation to proponents, namely the responsibility for sharing information with Indigenous groups about the potential effects of Ajax on Aboriginal Interests, and gathering and responding to concerns and ideas raised about measures to reduce the project related impacts on Aboriginal Interests. In the section 11 order, the EAO directed KAM to consult with Ashcroft regarding their perspectives and opinions about Ajax and the potential impacts of Ajax on their Aboriginal Interests. The following provides a summary of KAM's consultation activities from the issuance of the section 11 order until the end of the EIS/Application Review phase. A more detailed description of KAM's consultation with Ashcroft is provided in section 15 of the EIS/Application.

KAM notified Ashcroft about Ajax via letter on January 19, 2011, prior to submitting a project description to the Agency or EAO. KAM reports that they met with Ashcroft leadership five times during the pre-EIS/Application phase. Topics of discussion included site tours, traditional land use studies, involvement in the consultation process, contracting opportunities, potential effects of Ajax, such as water quality and effects of metals on nearby cattle, as well as opportunities for training and capacity building. Ashcroft, along with the EAO and KAM, participated in a site tour of Ajax on June 23, 2014.

The Agency sent a letter to KAM on June 9, 2014 to provide an update on the Agency's scope of consultation for Ajax and to describe the Agency's expectations with respect to KAM's Indigenous engagement requirements for the EIS/Application. This letter informed KAM of the Agency's preliminary determination that Ashcroft was owed a moderate depth of consultation. The letter also conveyed the requirement that KAM directly engage with Ashcroft, along with other Indigenous groups identified at a moderate and high level of consultation, to identify:

- The current use of lands and resources for traditional purposes;
- Potential effects of changes to the environment resulting from Ajax on current use of lands and resources for traditional purposes;
- Any concerns regarding impacts to rights as expressed by the groups; and
- Options for mitigating the effects, including where mitigation may also accommodate potential impacts to the groups' asserted rights.

At the direction of the Agency and EAO, KAM participated in working group activities throughout the EA, including coordinating meetings, making presentations, participating in discussions at working group meetings and topic-specific sub-working group meetings, organizing site tours for the working group, and preparing responses to address comments raised by working group members, including Ashcroft.

KAM reports that on October 24, 2014, they signed a Consultation and Benefits Agreement with Ashcroft to provide funding to support project presentations and participation in the EA process. While Ashcroft initially requested a traditional knowledge/traditional land use study, the Agency and EAO understand that they have not pursued such a study since signing the Consultation and Benefits Agreement and updated General Agreement.

25.3 POTENTIAL PROJECT IMPACTS ON ASHCROFT INDIAN BAND'S ABORIGINAL INTERESTS

An overview of the Agency and EAO's approach for assessing impacts on Aboriginal Interests is provided in section 23.3 of this Report.

The Agency and EAO understand that Ashcroft did not complete a traditional land and resource use study for Ajax. As a result, the Agency and EAO have limited information on the specific sites and resources used by Ashcroft for traditional purposes that could be impacted by Ajax.

Ashcroft asserts Aboriginal rights and title to its traditional territory and has stated this territory is a vast and ecologically diverse landscape with cultural values and interests inherent to Nlaka'pamux traditions. According to Ashcroft, these interests include medicine gathering, hunting, fishing, plant gathering as well as spiritual, archaeological, historical and current family gathering sites. Ashcroft indicated that they continue to carry out these practices throughout their asserted traditional territory, but indicated limited, if any, traditional land use by community members in the vicinity of Ajax. Ashcroft identified concerns during consultation including potential impacts on water quality, fish and fish habitat in the Thompson River, animals, including cattle, and impacts on asserted title in the project area. The Agency and EAO have taken these concerns into consideration in the assessment of potential impacts on Ashcroft's Aboriginal Interests.

The environmental effects of Ajax to valued components related to Aboriginal Interests, along with key mitigation measures, are described in Part B of this Report. As described in that section, routine project related activities would likely result in low to medium magnitude effects to the lands, waters, and resources that Indigenous groups use to carry out hunting, trapping, plant gathering, fishing, and other traditional activities. The majority of project related effects would be localized to the mine site, which the Agency and EAO understand to be of limited, if any, traditional use by Ashcroft.

In consideration of the information available to the Agency and EAO from the EA process, consultation with Ashcroft, Ashcroft's engagement with KAM, KAM's proposed mitigation measures, and the proposed EA Certificate conditions, Ajax is expected to result in a negligible-to-minor impact on Ashcroft's Aboriginal Interests.

25.3.1 OTHER CONCERNS IDENTIFIED BY ASHCROFT INDIAN BAND

Prior to EIS/Application review, Ashcroft expressed a number of other concerns related to Ajax during the consultation process. These concerns include the use of temporary foreign workers for Ajax employment, potential project related effects on cattle from metals, potential effects on water quality and quantity, including potential effects on the Thompson River, as well as cumulative effects, specifically with regards to TMX.

26 Lower Nicola Indian Band

Lower Nicola Indian Band (Lower Nicola) is part of the Nlaka'pamux Nation, whose asserted traditional territory encompasses part of south-central BC, from the northern United States to north of the City of Kamloops. Within the Nlaka'pamux Nation, Lower Nicola's asserted traditional territory is in the valley of the Lower Nicola River. Lower Nicola has 7,128 hectares of reserve land, spread out over 10 reserves. As of May 2017, Lower Nicola had a registered population of 1,254 (498 members are living on Lower Nicola's reserves, 53 are living on other reserves, and 700 are living off-reserve).

26.1 AGENCY AND EAO DEPTH OF CONSULTATION

The EAO conducted a preliminary assessment of the Nlaka'pamux Nation's claim for Aboriginal rights and title over the project area and stated that the Nlaka'pamux Nation has a weak *prima facie* claim of Aboriginal rights and title since this area is indicated by available ethnographers to be outside of their historical territory at the time of contact and at 1846 and there is no specific information of historic Nlaka'pamux use of this area. The available information indicates that the historical Nlaka'pamux territory boundary was a distance to the south of the project area. The EAO understands it is possible the Nlaka'pamux may have travelled into this area to trade at Kamloops, but that any such use would have likely been subject to the permission of the Kamloops division of the Secwepemc.

Given the nature and location of Ajax, and the potential impacts of Ajax on Lower Nicola's Aboriginal Interests, the EAO is of the view that the legal duty to consult Lower Nicola lies at the low end of the *Haida* consultation spectrum. In recognition of Lower Nicola's interest in potential impacts outside of the Ajax footprint, the EAO issued a section 11 order identifying Lower Nicola as one of the Indigenous groups to be consulted.

The Agency and federal responsible authorities determined that it was appropriate to consult Lower Nicola at a moderate depth of consultation. This assessment was based in part on Lower Nicola being a party to a legal protective writ, on behalf of the Nlaka'pamux Nation, that asserts existing Aboriginal title to a territory which includes the Ajax site. Lower Nicola also expressed concerns about the impacts of Ajax on their asserted Aboriginal rights and indicated that they were interested in participating in the EA and consultation process.

26.2 SUMMARY OF CONSULTATION

26.2.1 AGENCY AND EAO LED CONSULTATION

The following section describes the actions undertaken by the Agency and EAO in order to fulfil the Crown's duty to consult with Lower Nicola. Section 26.2.2 describes the procedural aspects of consultation undertaken by KAM at the Agency and EAO's direction on behalf of the Crown.

On September 13, 2011, the Agency sent Lower Nicola a letter with a proposed consultation approach consistent with a moderate depth of consultation, and invited comment and feedback on it, along with an invitation to apply for funding. The Agency did not receive comments from Lower Nicola on the proposed consultation approach.

The Agency and EAO invited Lower Nicola to review and comment on key documents related to the EA, including the Project Description, draft EISG/AIR, KAM's EIS/Application, and this Report. The Agency, EAO and Lower Nicola also engaged in ongoing correspondence, phone calls, and emails throughout the EA process.

The EAO provided information on the EA process and sought input from Lower Nicola on how they could be involved in a letter dated September 20, 2011. The letter also requested comment on the draft section 11 order, which outlined First Nation consultation responsibilities. The EAO did not receive comments from Lower Nicola, and the section 11 order was issued on January 11, 2012.

The EAO provided Lower Nicola with the results of the initial provincial strength of claim assessment on November 30, 2012, and offered Lower Nicola an opportunity to submit additional information regarding traditional use of the project area.

In April 2011, the EAO issued a section 11 order, establishing the working group, which is co-chaired by the Agency. Lower Nicola was invited to participate in all working group meetings and was represented at meetings in June 2014, July 2015, and April 2016. Through the working group, Lower Nicola was provided with opportunities to review and comment on the selection of valued components for the effects assessment, design of baseline study programs, environmental and socio-economic studies, and any issues and information requirements related to the EIS/Application.

On December 19, 2014, at Lower Nicola's request, the Agency and EAO met with Lower Nicola to discuss the EA process and engagement between government and Lower Nicola regarding Ajax. At this meeting, Lower Nicola identified a number of concerns related to Ajax, including potential effects to water systems, effects associated with dust, effects on hunting and fishing, as well as effects on wildlife (e.g. moose and deer), plants (e.g. soapberries, huckleberries, and herbs), fish, and birds. Lower Nicola, the Agency, and the EAO also discussed consultation processes to identify opportunities for improvement.

On February 10, 2015, Lower Nicola wrote the EAO to express concerns regarding the lack of a government to government engagement protocol. On February 23, 2015, the EAO responded with further clarification on the level of consultation supported by available information and clarification that a deeper level of consultation would not be considered unless additional information to support Lower Nicola's asserted claims in the project area was provided. The letter also summarized the specific opportunities in which Lower Nicola was engaged to date and clarified future opportunities for future consultation. In this letter, responded to Lower Nicola's request for an engagement protocol, stating that a separate engagement protocol was not necessary to achieve the purposes described in the protocol given the consultation activities conducted and planned already. The EAO did not receive a response to this letter.

In July 2015, the Agency and EAO notified Lower Nicola that the EISG/AIR was accepted. The EAO's letter also included responses from KAM to comments received from Lower Nicola.

When KAM submitted the EIS/Application for evaluation, Lower Nicola was provided with a copy of the EIS/Application and an opportunity to submit comments during the 30-day evaluation period. Through the working group, the Agency and EAO continued to provide opportunities for Lower Nicola to provide comments on KAM's EIS/Application and the potential impacts of Ajax to Lower Nicola. Lower Nicola was also provided with the opportunity to review and provide comments on this Report. Further, Lower Nicola will have the opportunity to have its views on this Report included in the package of materials sent to the responsible minister if Ajax is referred for decision.

As part of an EA, the Agency and EAO provide funding to Indigenous groups to assist with costs associated with their participation in the process. In September 2011, Lower Nicola was provided $5,000 in capacity funding by the EAO to support its involvement in the pre-EIS/Application phase of the EA. In January of 2016, Lower Nicola was provided an additional $10,000 by the EAO to support its involvement in the EIS/Application Review phase. The Agency allocated $30,150 to Lower Nicola through the Participant Funding Program.

26.2.2 KAM LED CONSULTATION

During an EA, the EAO delegates some procedural aspects of Aboriginal consultation to proponents, namely the responsibility for sharing information with Indigenous groups about the effects of Ajax on Aboriginal Interests, and gathering and responding to concerns and ideas raised about measures to reduce the project related impacts on Aboriginal Interests. In the section 11 order, the EAO directed KAM to consult with Lower Nicola regarding their perspectives and opinions about Ajax and the potential impacts of Ajax on their Aboriginal Interests. The following provides a summary of KAM's consultation activities from the issuance of the section 11 order until the end of EIS/Application review. A more detailed description of KAM's consultation with Lower Nicola is provided in section 15 of the EIS/Application.

At the direction of the Agency and EAO, KAM participated in working group activities throughout the EA, including coordinating meetings, making presentations, participating in discussions at working group meetings and topic-specific sub-working group meetings, organizing site tours for the working group, and preparing responses to address comments raised by working group members, including Lower Nicola.

KAM reports that they notified Lower Nicola about Ajax on January 19, 2011, and met with Chief and Council and representatives from Lower Nicola eight times during the pre-EIS/Application period. During these meetings, Lower Nicola raised concerns to KAM regarding potential Ajax-related effects from dust on cattle grazing, wildlife, and harvested plants, as well as potential effects on lakes from water usage associated with Ajax.

The Agency sent a letter to KAM on June 9, 2014 to provide an update on the Agency's scope of consultation for Ajax and to describe the Agency's expectations with respect to KAM's Indigenous engagement requirements for the EIS/Application. This letter informed KAM of the Agency's preliminary determination that Lower Nicola was owed a moderate depth of consultation. The letter also conveyed the requirement that KAM directly engage with Lower Nicola, along with other Indigenous groups identified at a moderate and high level of consultation, to identify:

- The current use of lands and resources for traditional purposes;
- Potential effects of changes to the environment resulting from Ajax on current use of lands and resources for traditional purposes;
- Any concerns regarding impacts to rights as expressed by the groups; and,
- Options for mitigating the effects, including where mitigation may also accommodate potential impacts to the groups' asserted rights.

Lower Nicola and KAM signed a Capacity Funding Agreement on July 28, 2015. This agreement provides a range of support to Lower Nicola, including funding a traditional knowledge and traditional land use study. The Agency and EAO understand that the development of this study is still under way.

Lower Nicola participated in a site tour of Ajax on January 19, 2015.

In a letter to EAO dated July 11, 2017, Lower Nicola expressed dissatisfaction with KAM's level of consultation throughout the EA.

26.3 POTENTIAL PROJECT IMPACTS ON LOWER NICOLA INDIAN BAND'S ABORIGINAL INTERESTS

An overview of the Agency and EAO's approach for assessing impacts on Aboriginal Interests is provided in section 23.3 of this Report. The discussion in this section focuses on potential impacts of Ajax on Lower Nicola's Aboriginal Interests.

KAM provided Lower Nicola with capacity funding to conduct a traditional knowledge and traditional land use study. The Agency and EAO understand that Lower Nicola did not complete this study prior to KAM's submission of its EIS/Application, nor during the review period. KAM has stated that, where appropriate, additional information made available by Lower Nicola will be considered in ongoing planning for Ajax.

Since Lower Nicola has not yet completed a traditional knowledge and traditional land use study for Ajax, the Agency and EAO have limited information on the specific sites and resources used by Lower Nicola for traditional purposes that could be impacted by Ajax. As a result, the Agency and EAO have considered publically-available information on traditional land use in the vicinity of Ajax, particularly traditional land use information submitted during the review process for the TMX.[119] The Agency and EAO recognize that this information reflects spatial and temporal uncertainties; however, the Agency and EAO have used this information in a supplementary way in order to gain a greater understanding of traditional land use in the project area, as well as in Lower Nicola's asserted traditional territory.

26.3.1 HUNTING AND TRAPPING

According to traditional land use information submitted during the review process for TMX, Lower Nicola community members historically hunted numerous species including moose, deer, elk, mountain goat, bighorn sheep, beaver, bear, ducks, geese, and grouse. Lower Nicola community members also trapped beaver, coyote, marten, mink, muskrat, rabbit, fox, grouse, ermine, lynx, and mink. Currently, community members are known to hunt moose and deer, trap muskrat, beaver, bobcat, lynx, mink, and weasel.[120] It is understood that Lower Nicola traditionally followed a seasonal round of traditional land and resource use and moved throughout their territory according to the season.

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[119] https://apps.neb-one.gc.ca/REGDOCS/File/Download/2393281; https://apps.neb-one.gc.ca/REGDOCS/File/Download/2392720; https://apps.neb-one.gc.ca/REGDOCS/File/Download/2578724

[120] Ibid

The Agency and EAO are not aware of any information regarding the use of the project area for hunting and trapping by Lower Nicola community members that was identified during the EA for Ajax. The Agency and EAO considered that during the review process for TMX, several hunting and trapping areas were identified as important to Lower Nicola community members.[121] The Agency and EAO understand that all but four areas are over 15 km away from the mine site. The closest of the four areas to the mine site is a traditional hunting area along the Thompson River, which is approximately 7 km from the mine site at its closest point. The Agency and EAO note that specific locations for some of the hunting and trapping areas identified in Lower Nicola's traditional use information for TMX are unknown.

The Agency and EAO understand that Lower Nicola raised concerns related to potential environmental effects of Ajax that could affect hunting and trapping activities. These concerns include potential effects from dust on grazing cattle and wildlife harvested in the project area and near Lac Le Jeune. Lower Nicola also expressed issues with the ecological risk assessment, particularly the concern that KAM may have underestimated baseline and future metals conditions in soils and plants ingested by grazing ungulates. Lower Nicola expressed the concern that only monitoring of metals is planned with no mitigation in the event of elevated metal levels.

The EA considered effects to amphibians, reptiles, migratory birds, raptors, non-migratory gamebirds, badgers, and bats, with a particular focus on species that are of regional concern, or that are listed species known to be vulnerable to habitat or population loss (see Wildlife in section 6 of this Report). The Agency and EAO concluded that there would not be significant adverse effects or significant adverse cumulative effects to amphibians, reptiles, migratory birds, raptors or non-migratory game birds, badgers, and bats. With regards to potential site-specific impacts, the Agency and EAO note that known hunting and trapping areas identified as important to Lower Nicola community members do not overlap with the mine site. As a result, Ajax is not expected to disrupt Lower Nicola community members from accessing known hunting and trapping areas. The distance from these known sites to the mine site also reduces the likelihood that Ajax would directly impact social, cultural, spiritual, and experiential aspects of Lower Nicola's hunting and trapping activities in the identified locations.

In consideration of the available information, KAM's proposed mitigation measures, the EAO's proposed EA Certificate conditions, the Agency and EAO's analysis of residual and cumulative effects to wildlife and other valued components related to hunting and trapping activities, as well as information available to the Agency and EAO about areas where Lower Nicola hunts and traps, Ajax is expected to result in negligible impacts on Lower Nicola's asserted Aboriginal rights to hunt and trap.

26.3.2 PLANT GATHERING

In information provided during the review process for TMX, Lower Nicola communicated that community members gathered a variety of roots, berries, seeds, nuts, tree bark, lichen, mushrooms, tobacco, cedar, and other wild plants. Lower Nicola also communicated that currently, community members harvest berries and mushrooms. Lower Nicola community members used controlled burning to clear brush in order to grow berries and roots for harvesting. Plants gathered were used for food, medicine, dye, cleansing agents, adhesives, fuel, building material, baskets caches, and trade.[122]

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[121] Ibid

The Agency and EAO are not aware of any information regarding the use of the project area for plant gathering by Lower Nicola community members that was identified during the EA for Ajax. During the review process for TMX, several plant gathering areas were identified as important to Lower Nicola community members including, but not limited to, areas along the Coldwater River, Nicola Lake, Quilchena Creek, and Zoht Indian Reserves 4 and 5. The Agency and EAO understand that most of these plant gathering areas are over 20 km from the mine site, with the exception of a traditional strawberry picking site at Coal Hill, which is located within approximately one km of the mine site. The specific locations for some of the plant gathering areas identified in Lower Nicola's traditional use information for TMX are unknown.

The Agency and EAO understand that Lower Nicola raised concerns related to potential Ajax impacts on plant gathering activities, including potential effects from dust on food and medicinal plants harvesting in the project area and near Lac Le Jeune. The EA considered the effects of Ajax on the loss, alteration, and degradation of grasslands, wetlands and rare plants in the project footprint and in the local study area (see Vegetation in section 5). The Agency and EAO concluded that there would not be significant adverse effects or significant adverse cumulative effects to grasslands, wetlands, or rare plant communities. The Agency and EAO note that known plant gathering areas identified as important to Lower Nicola community members do not overlap the mine site, which significantly reduces the potential that plant gathering activities at these sites, and access to these sites, could be directly impacted by Ajax. With the exception of the traditional strawberry picking site at Coal Hill, the distance from known Lower Nicola plant gathering sites to the mine site also reduces the likelihood that Ajax would directly impact social, cultural, spiritual, and experiential aspects of Lower Nicola's plant gathering activities in the identified locations. The Agency and EAO acknowledge that project related effects from dust and noise may adversely impact the experiential aspect of any current use of the traditional strawberry picking at Coal Hill.

In consideration of the available information, KAM's proposed mitigation measures, the EAO's proposed EA Certificate conditions, the Agency and EAO's analysis of residual and cumulative effects to vegetation and terrestrial ecosystems and other valued components related to plant gathering activities, as well as information available to the Agency and EAO about areas where Lower Nicola gathers plants, Ajax is expected to result in negligible-to-minor impacts on Lower Nicola's asserted Aboriginal right to gather plants.

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[122] Ibid

26.3.3 FISHING

Information submitted during the TMX review process describes Nlaka'pamux economic, cultural, and social lifestyles and the Nlaka'pamux people's rich history with respect to fish harvesting, particularly salmon.[123] According to traditional land use information presented during the TMX review process, fishing was historically a communal activity for Lower Nicola, as each community had a fishery that was typically designated by a fishing rock. Community members used various methods, including fish traps, spears, gill nets, bag nets, and corralling fish with stones, in order to catch trout, salmon, Dolly Varden, suckers, kokanee, and whitefish. The Nicola and Fraser Rivers are of particular importance to the Lower Nicola and fish such as burbot, kokanee, whitefish, and other species continue to be an important resource for the community.

The Agency and EAO are not aware of any information regarding the use of the project area for fishing by Lower Nicola community members that was identified during the EA for Ajax. The Agency and EAO understand that most of the fishing areas identified during the review process for TMX are over 20 km from the mine site, with the exception of a traditional fishing area in the Thompson River and a traditional fishing area at Lac Le Jeune (approximately 13 km from the mine site).[124]

The Agency and EAO understand that Lower Nicola raised concerns related to potential impacts of Ajax on fishing activities. These concerns include potential effects on the ability of Lower Nicola community members to engage in fishing, and potential downstream effects from changes in water quantity and quality. The EA considered the effects of Ajax on fish and fish habitat (section 4). The Agency and EAO concluded that there would not be significant adverse effects or significant adverse cumulative effects to fish and fish habitat. The Agency and EAO note that known fishing areas identified as important to Lower Nicola community members do not overlap the mine site, which significantly reduces the potential that fishing activities at these sites, and access to these sites, could be directly impacted by Ajax. The distance from known Lower Nicola fishing sites to the mine site also reduces the likelihood that Ajax would directly impact social, cultural, spiritual, and experiential aspects of
Lower Nicola's fishing activities in the identified locations.

In consideration of the available information, KAM's proposed mitigation measures, the EAO's proposed EA Certificate conditions, the Agency and EAO's analysis of residual and cumulative effects to fish and fish habitat and other valued components related to fishing activities, as well as information available to the Agency and EAO about areas where Lower Nicola fishes, Ajax is expected to result in negligible impacts on Lower Nicola's asserted Aboriginal right to fish.

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[123] Ibid
[124] Ibid

26.3.4 *SITES OF CULTURAL IMPORTANCE*

In this section, sites of cultural importance refer to trails/travelways, habitation sites, gathering places, and sacred areas are discussed. During the review process for TMX, Lower Nicola described how the cultural well-being of Aboriginal communities depends in large part on members' continued ability to access and use traditionally important places and resources on the land.[125] The knowledge and practices of traditional land and resource use are often family-specific, meaning that certain families have specialized knowledge about, or near-exclusive use of, some areas on the territory. It is understood that Lower Nicola community members lived in villages containing domed pithouses that consisted of a few families to several hundred individuals prior to European colonization.[126] Community members dispersed during the summer and stayed at seasonal summer camps.[127] Lower Nicola community members used trails and travelways throughout the Nicola Valley and beyond to practice traditional and other cultural activities.[128] The use of trails and travelways was also important for trading with other First Nation communities along the Pacific Coast.[129] Historically, locations where Lower Nicola community members created pictographs became important community gathering places.[130]

The Agency and EAO are not aware of any information regarding the use of the project area for sites of cultural importance by Lower Nicola community members that was identified during the EA for Ajax. The Agency and EAO considered that, during the review process for TMX, several sites of cultural importance were identified as important to Lower Nicola community members.[131] The Agency and EAO understand that most of these sites of cultural importance are over 20 km from the mine site. The closest site of cultural importance to the mine site is a traditional habitation site at Rush Lake, which is approximately 2 km from the mine site.[132] The Agency and EAO note that specific locations for some of the sites of cultural importance identified in Lower Nicola's traditional use information for TMX are unknown.

Lower Nicola expressed concern regarding the proximity of Ajax to lands that are of cultural importance to Lower Nicola; however, Lower Nicola did not provide the Agency and EAO with information on the general locations of these areas/lands. In terms of potential site-specific impacts, the Agency and EAO note that known sites of cultural importance identified as important to Lower Nicola community members do not overlap with the mine site. As a result, Ajax is not expected to directly impact Lower Nicola's access to these sites. With the exception of the traditional habitation site at Rush Lake, the distance of the mine site from known sites of cultural importance also reduces the likelihood that Ajax would directly impact social, cultural, spiritual, and experiential aspects of Lower Nicola's use of these sites. The Agency and EAO acknowledge that project related effects from dust have the potential to adversely impact the quality of experience of any current use of the traditional habitation site at Rush Lake.

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[125] https://apps.neb-one.gc.ca/REGDOCS/File/Download/2904914

[126] https://apps.neb-one.gc.ca/REGDOCS/File/Download/2393281; https://apps.neb-one.gc.ca/REGDOCS/File/Download/2392720; https://apps.neb-one.gc.ca/REGDOCS/File/Download/2578724

[127] Ibid

[128] Ibid

[129] Ibid

[130] Ibid

[131] Ibid

[132] Ibid

In consideration of the available information, KAM's proposed mitigation measures, the EAO's proposed EA Certificate conditions, the Agency and EAO's analysis of residual and cumulative effects to valued components related to sites of cultural importance, as well as information available to the Agency and EAO about areas where Lower Nicola has identified sites of cultural importance, Ajax is expected to result in negligible-to-minor impacts on Lower Nicola's sites of cultural importance.

26.3.5 OTHER CONCERNS IDENTIFIED BY LOWER NICOLA INDIAN BAND

Lower Nicola expressed several other concerns regarding Ajax. These concerns include potential impacts of Ajax on the City of Kamloops, given that many Lower Nicola community members reside in Kamloops, potential failure of the tailings storage facility, and impacts on TMX, which is currently located under the proposed mine rock and tailings storage facility. Lower Nicola also expressed an interest in economic diversification and benefitting from education, training, employment and business opportunities provided by Ajax.

Any concerns related to technical issues that were raised by Lower Nicola were considered during the Agency and EAO's review of the EIS/Application. Part B of this Report provides a discussion of related technical issues, including EAO's conclusions regarding the significance of effects and a description of legally binding EA Certificate conditions proposed by the EAO.

27 Whispering Pines/Clinton Indian Band

Whispering Pines/Clinton Indian Band (Whispering Pines/Clinton) is a member of the Secwépemc Nation, and asserts collective Aboriginal rights and title to an area that overlaps with the project footprint. As of May 2017, Whispering Pines/Clinton has a registered population of 162, of which 52 live on reserve. The community is located in North Kamloops, British Columbia (BC), near Heffley Creek, which is approximately 65 km north of the confluence of the North and South Thompson Rivers and about 35 km north of Kamloops. Whispering Pines/Clinton has three reserves: *Clinton No. 1*, *Kelly Creek 3*, and *Whispering Pines 4*. They are known as the Pelltiq't People and are currently members of the Shuswap Nation Tribal Council.

Whispering Pines/Clinton is a party to the Secwepemc Nation protective *Writ of Summons*, which was filed in the BC Supreme Court on December 10, 2003, asserting Aboriginal title to a territory identified in the *Writ*. The *Writ of Summons* involves: Adams Lake Indian Band, Bonaparte Indian Band, Llenlleney'ten First Nation (High Bar), Neskonlith Indian Band, Simpcw First Nation, Skeetchestn Indian Band, Spallumcheen Indian Band, Tk'emlúps te Secwépemc, and Whispering Pines/Clinton.

27.1 AGENCY DEPTH OF CONSULTATION

As mentioned in section 23.2 of this Report, the Agency and EAO determine the appropriate depth of consultation for each identified Indigenous group based on the information available in regard to the exercise of asserted Aboriginal rights, including title, and the potential for adverse impacts on those rights from Ajax.

The Agency determined that it was appropriate to consult Whispering Pines/Clinton at a moderate depth of consultation. The Agency provided Whispering Pines/Clinton a letter on July 26, 2013, providing them with a proposed consultation approach consistent with a moderate depth of consultation, and invited comment and feedback on it. This assessment was based in part on information provided by Whispering Pines/Clinton indicating that members from their community exercise Aboriginal rights relating to hunting and fishing at the Ajax site, in conjunction with the Agency's preliminary understanding of the nature, extent and severity of potential impacts resulting from Ajax. Whispering Pines/Clinton further indicated that they were asserting Aboriginal rights and title over the project area and were interested in consultation. Furthermore, the Agency understands that all Secwépemc bands held lands in common pre-European contact, with certain bands or divisions acting as stewards over areas within the larger Secwépemc Nation. Whispering Pines/Clinton is a member of the Secwépemc Nation, and the Agency understands that Whispering Pines/Clinton is a member of the Fraser River Division, along with High Bar First Nation and Esk'etemc First Nation.

27.2 SUMMARY OF CONSULTATION

27.2.1 AGENCY LED CONSULTATION

The Agency identified Whispering Pines/Clinton as being potentially impacted by Ajax upon receipt of the Project Description, and sent an initial early notification letter in March 2011. In February 2013, the Agency sent a follow-up letter to Whispering Pines/Clinton, indicating that due to a lack of response the Agency was assuming that Whispering Pines/Clinton was not interested in being consulted in relation to Ajax. Whispering Pines/Clinton then requested more information and soon after confirmed their interest in being consulted with respect to Ajax. The Agency has engaged Whispering Pines/Clinton in consultation activities since that time.

Whispering Pines/Clinton was invited to review and comment on key documents related to the EA, including the draft revised EISG/AIR, the EIS/Application, and a draft of this Report. Note that while Whispering Pines/Clinton was not a member of the working group, the Agency provided Whispering Pines/Clinton with documents that were shared with the working group for comment, in order to meet the consultation commitments in the Agency's consultation approach. The Agency also regularly updated Whispering Pines/Clinton on the progress of the EA and provided information requests to inform Whispering Pines/Clinton's participation in the EA.

The Agency and Whispering Pines/Clinton engaged in ongoing correspondence throughout the EA process. However, the Agency has not received any response to its notification emails with respect to project updates (such as the issuance of Information Requests to KAM, resumption of federal timelines, and joint Agency-EAO Report) since June 2016.

Through the Agency's Participant Funding Program, Whispering Pines/Clinton was allocated $40,000 to support their participation in the EA process.

27.2.2 EAO LED CONSULTATION

The EAO issued an order under section 11 on January 11, 2012, that specified the consultation activities that the EAO and KAM would undertake with each of the Indigenous groups identified as potentially being affected by Ajax. Whispering Pines/Clinton was not included in this order. On July 23, 2015, in response to Whispering Pines/Clinton's request for consultation on Ajax, the EAO amended the section 11 order to include consultation with the Whispering Pines/Clinton at the "notification level", to ensure Whispering Pines/Clinton could be informed of the progress of the EA and that they had an opportunity to raise issues to the EAO for discussion. Following that, and for the remainder of the EA, the EAO provided Whispering Pines/Clinton with notification of key project milestones.

27.2.3 KAM LED CONSULTATION

Efforts made by KAM to obtain information about the Indigenous groups' practice of rights and use of resources, as well as the assessment of potential impacts of Ajax, helped inform the Agency's consultation process.

The Agency sent a letter to KAM on June 9, 2014, to provide an update on the Agency's scope of consultation for Ajax and to describe the Agency's expectations with respect to KAM's Indigenous engagement requirements for the EIS/Application. This letter informed KAM of ongoing consultation between the Agency and Whispering Pines/Clinton, including the allocation of Participant Funding, and the Agency's preliminary determination that Whispering Pines/Clinton was owed a "moderate depth" of consultation. The letter also conveyed the requirement that KAM directly engage with Whispering Pines/Clinton, along with other Indigenous groups identified at a moderate and high level of consultation, to identify:

- The current use of lands and resources for traditional purposes;
- Potential effects of changes to the environment resulting from Ajax on current use of lands and resources for tradition purposes;
- Any concerns regarding impacts to rights as expressed by the groups; and
- Options for mitigating the effects, including where mitigation may also accommodate potential impacts to the groups' asserted rights.

Subsequent to this letter, KAM commenced engagement with Whispering Pines/Clinton. Engagement consisted of e-mails, correspondence, phone calls, meetings with Chiefs and legal counsel, two community meetings, and attempts to reach a Project Development Agreement.

KAM negotiated a Capacity Funding Agreement with Whispering Pines/Clinton in May 2015, in part to fund the preparation of a traditional land use study which, at the time of writing this Report, KAM has not yet received. On July 15, 2015, 24 Whispering Pines/Clinton members and KAM participated in a community meeting, and a second community meeting took place on August 19, 2015. In March 2016, KAM met with Chief and council to provide a project update and discuss next steps. KAM reached out to Whispering Pines/Clinton several times following that meeting to continue discussions about a Project Development Agreement, but no further meetings were held.

27.3 POTENTIAL PROJECT IMPACTS ON WHISPERING PINES/CLINTON INDIAN BAND'S ABORIGINAL INTERESTS

Through the EA process and engagement with KAM, Whispering Pines/Clinton raised concerns related to fishing, hunting, plant gathering, and title. With respect to fishing, Whispering Pines/Clinton expressed concerns about potential effects on fish and fish habitat as a result of contamination of waterbodies and cumulative effects; potential effects of noise and vibration on fishing; and, potential impacts of leaks, seepages, or catastrophic tailings pond breaches on fish-bearing waterways.

With respect to hunting, Whispering Pines/Clinton raised concerns related to potential effects on hunted species from contamination and/or cumulative effects, potential effects on migratory birds which may use Goose Lake, and potential effects of noise and vibrations on hunting. Whispering Pines/Clinton also noted concerns related to potential effects on harvested species from contamination and cumulative effect and potential soil contamination from fugitive dust emissions which may impact plants, rare plants, and sensitive ecological communities.

The Agency notes that Whispering Pines/Clinton also indicated that Ajax is located within the territory over which they claim Aboriginal title (as part of the Secwépemc Nation), and that Whispering Pines/Clinton members exercise a range of the aforementioned asserted Aboriginal rights.

The Agency and EAO understand that a Whispering Pines/Clinton traditional land use study was not completed for Ajax. KAM collected information about potential impacts on Whispering Pines/Clinton's asserted Aboriginal rights through meetings, written communication, literature reviews and secondary data collection. Beyond the information gathered by KAM in their engagement activities with Whispering Pines/Clinton, the Agency and EAO did not receive any further information pertaining to the exercise of asserted Aboriginal rights or the current use of lands and resources for traditional purposes that may be impacted by Ajax.

The Agency and EAO have taken these asserted rights, potential impacts, and related concerns into account with respect to the assessment of the seriousness of potential impacts on Whispering Pines/Clinton's asserted Aboriginal rights. The Agency and EAO have also taken into consideration the characterization and assessment of impacts to Whispering Pines/Clinton's rights conducted by KAM, in the EIS/Application, as well as the Agency and EAO's analysis of relevant valued components in Part B of this Report.

The environmental effects of Ajax to valued components related to Aboriginal Interests, along with key mitigation measures, are described in Part B of this Report. As described in that section, routine project related activities are likely to result in low to medium magnitude effects on the lands, waters and resources that Indigenous groups use to exercise their asserted hunting, trapping, plant gathering, fishing and other Aboriginal rights. The majority of project related effects will be localized to the mine site, which the Agency and EAO understand to be of limited, if any, traditional use by
Whispering Pines/Clinton.

Beyond asserting title through reference to the Secwépemc Nation's *Writ of Summons* in 2003, Whispering Pines/Clinton did not provide any information pertaining to the nature or degree of potential impacts from Ajax on their asserted Aboriginal title.

In consideration of the information available to the Agency and EAO from the EA process, consultation with Whispering Pines/Clinton, Whispering Pines/Clinton's engagement with KAM, KAM's proposed mitigation measures, and the proposed EA Certificate conditions, Ajax is expected to result in a negligible-to-minor impact on Whispering Pines/Clinton's Aboriginal Interests.

27.3.1 OTHER CONCERNS IDENTIFIED BY WHISPERING PINES/CLINTON INDIAN BAND

KAM recorded the following concerns in the EIS/Application, identified through consultation with Whispering Pines/Clinton:

- Economic conditions;
- Social conditions;
- Health conditions;
- Water quantity and water quality;
- Reclamation and closure;
- Accidents and malfunctions; and
- Cumulative effects.

28 Métis Nation British Columbia

The closest MNBC chartered communities to Ajax are Two Rivers Métis Society, located in Kamloops; Ashcroft and District Métis Association; and Nicola Valley and District Métis Society. MNBC represents their chartered communities for consultation purposes and identified those three communities as potentially impacted by Ajax.

MNBC has stated that the Métis have had an established community in the Interior of BC for more than 200 years and still use the land and resources for traditional purposes, and furthermore, that MNBC citizens from adjacent chartered communities are currently exercising their asserted Aboriginal rights to harvest (hunt, fish, trap and gather plants) within the project footprint.

28.1 AGENCY DEPTH OF CONSULTATION

As mentioned in section 23.2 of this Report, the Agency determines the appropriate depth of consultation for each identified Indigenous group based on the information available in regard to the exercise of asserted Aboriginal rights, including title, and the potential for adverse impacts on those rights from Ajax.

The Agency determined that it was appropriate to consult MNBC at the low end of the *Haida* consultation spectrum. The Agency provided MNBC a letter on July 7, 2011, informing them of the Agency's preliminary depth of consultation assessment, the Agency's understanding of the exercise of asserted Métis rights in the area, and potential adverse impacts from Ajax on those rights. The Agency outlined a proposed consultation approach based on this assessment, and invited comment and feedback on both the proposed consultation approach and the preliminary assessment of impacts to asserted Métis Aboriginal rights.

28.2 SUMMARY OF CONSULTATION

28.2.1 *AGENCY LED CONSULTATION*

The Agency sent MNBC an early notification letter on March 16, 2011, informing them that the Agency had received a Project Description from KAM and had identified potential impacts of Ajax to the asserted Aboriginal rights of the Métis communities represented by MNBC. In this letter, the Agency also requested information pertaining to the exercise of rights and other interests in the vicinity of Ajax, to better inform the development of an appropriate consultation approach and a better understanding of potential impacts. Information pertaining to the Participant Funding Program was also provided. MNBC confirmed in June 2011 that they were interested in being involved in the EA.

MNBC was invited to review and comment on key documents relating to the EA, including the draft revised EISG/AIR, the EIS/Application, and a draft of this Report.

The Agency and MNBC engaged in ongoing correspondence and emails throughout the EA process. The Agency also invited MNBC to participate in information sessions, which took place on November 25-26, 2014, February 16-17, 2016, and March 15-16, 2016.

Through the Agency's Participant Funding Program, MNBC was allocated $25,700 to support their participation in the EA process.

28.2.2 KAM LED CONSULTATION

Efforts made by KAM to obtain information about the Indigenous group's practice of rights and use of resources, as well as the assessment of potential impacts of Ajax, helped inform the Agency's consultation process.

KAM commenced its engagement activities with MNBC in January 2012 by providing MNBC with information about Ajax and requesting that MNBC confirm their interest in participating in the EA for Ajax. Engagement activities included discussion and negotiation of an Industry Protocol Agreement (completed December 2014), capacity funding agreement (completed December 2014), and three community meetings (one for each Métis community). MNBC provided KAM with a harvester report on January 30, 2015, and socio-economic information specific to Métis in relation to the mining industry on March 23, 2015. KAM provided MNBC with Part C of the EIS/Application for their review, and requested comments, but no further engagement was undertaken following the submission of the EIS/Application. Prior to the submission of the EIS/Application, KAM informed MNBC that they would be contacted to discuss project employment and business opportunities should Ajax receive provincial and federal approvals.

28.3 POTENTIAL PROJECT IMPACTS ON MÉTIS NATION BRITISH COLUMBIA'S ABORIGINAL INTERESTS

A discussion of the Agency's approach for assessing the seriousness of impacts on Aboriginal rights is provided in section 23.3 of this Report.

The Agency notes that MNBC has stated that a range of land use activities are undertaken by Métis community members in the project area, including: hunting, trapping, fishing, gathering food and medicines, gathering of firewood, cultural and spiritual practices, camping, and hiking. MNBC has identified Goose Lake as a plant gathering area. MNBC also stated that the construction and operation of Ajax would negatively impact Métis traditional knowledge and land use, and put local Métis Aboriginal rights and traditional land uses at risk.

Additionally, MNBC citizens are concerned about the sustainable use of natural resources, including the management of natural resources to meet present needs without compromising the needs of future generations; the stewardship of natural resources based on an ethic of respect for the land; balancing economic, production, spiritual, ecological, and traditional values of natural resources to meet the economic, social, and cultural needs of the Métis peoples and other Indigenous and non-Indigenous communities; conserving biological diversity, soil, water, fish, wildlife, scenic diversity, and other natural resources; and restoring damaged ecologies. MNBC citizens are concerned that these may be impacted by Ajax.

The Agency did not receive any further information pertaining to the exercise of asserted Aboriginal rights or the current use of lands and resources for traditional purposes that may be impacted by Ajax. KAM provided funding to MNBC in relation to the MNBC-KGHM/Ajax Initial Project Report, and collected information through literature reviews and secondary data collection.

The Agency has considered these asserted rights, potential impacts, and related concerns with respect to its assessment of the seriousness of potential impacts on MNBC citizen's asserted Aboriginal rights. The Agency has also taken into consideration the characterization and assessment of impacts to MNBC citizen's asserted rights conducted by KAM in the EIS/Application, as well as the Agency and EAO's analysis of relevant valued components in Part B of this Report. Furthermore, the Agency notes that while MNBC commented on various aspects of KAM's assessment of environmental effects in the EIS/Application, they did not provide any comments related to KAM's assessment of impacts to their asserted Aboriginal rights.

The environmental effects of Ajax to valued components related to Aboriginal Interests, along with key mitigation measures, are described in Part B of this Report. As described in that section, routine project related activities are likely to result in low to medium magnitude effects on the lands, waters and resources that Indigenous groups use to exercise their asserted hunting, trapping, plant gathering, fishing, and other Aboriginal rights. The majority of project related effects will be localized to the mine site, which the Agency understands to be of limited, if any, traditional use by MNBC citizens, with the exception of Goose Lake, where MNBC has indicated that plant gathering occurs.

In consideration of the information available to the Agency from the EA process, consultation with MNBC, MNBC's engagement with KAM, KAM's proposed mitigation measures, and the proposed an EA Certificate conditions, Ajax is expected to result in a minor impact on MNBC's asserted Aboriginal rights.

28.3.1 OTHER CONCERNS IDENTIFIED BY MÉTIS NATION BRITISH COLUMBIA

According to a letter sent by MNBC to the Agency on April 11, 2016, in relation to the concerns identified above, MNBC is in agreement with most of KAM's assessments, assuming proper implementation of the stipulated mitigation measures, with a few exceptions. Outstanding concerns related to groundwater quality, the probability of direct habitat loss influencing productivity of fish populations, inadequate information relating to the resiliency and restoration of rare and sensitive ecological communities, recommendation that cliffs within the regional study area be surveyed to assess potential quality of cliff habitat for cliff nesting raptors, and the cultural relevance of the loss of grouse lek sites.

29 Weighing Impacts on Aboriginal Interests with Other Interests

As described in *Haida*, the Crown must balance the potential impacts to Aboriginal Interests with other societal interests, which can include the potential social, environmental, and economic costs and benefits of Ajax. In balancing the project benefits with the impacts on Aboriginal Interests, the EAO holds the view that the following factors regarding Ajax, discussed elsewhere in this Report, are relevant to consider:

- Potential impacts of Ajax on Aboriginal Interests (Part C);
- Significance of any environmental and socio-economic effects of Ajax (Part B);
- Resources or values that may no longer be available for future generations;
- Benefits of Ajax to the local, regional, and provincial economy as summarized in Estimated Project Benefits (section 1.6); and
- Benefits of Ajax to affected Indigenous groups.

The EAO understands that Ashcroft has entered into a confidential agreement with KAM and that KAM has been seeking to enter into benefits agreements with SSN, Lower Nicola, and Whispering Pines/Clinton. Through these agreements, KAM would provide economic opportunities that could include initiatives to support employment, contracting, and business development through identifying economic opportunities specific to each individual Indigenous group. Potential economic benefits of Ajax to SSN are further discussed in section 24.4 (see Aboriginal Title and Indigenomics).

As described in Consultation by the Province (section 24.2.2), the Province offered accommodations to SSN to address potential residual economic effects of Ajax. At the time of writing this Report, no accommodation agreements have been signed between SSN and the Province, and SSN has indicated that it rejected the Province's accommodation offer.

Part D – Conclusions

30 Conclusions of the Agency and EAO

The Agency and EAO have taken into account the following information in determining whether or not Ajax is likely to cause significant adverse effects:

- Documents submitted by KAM, including the EIS/Application and supplemental information provided during the review period;
- Comments on the EIS/Application and supplemental information from the working group members including Indigenous groups, the City of Kamloops, and government agencies, and KAM's responses to those comments;
- Comments received from the public, including comments submitted during the public comment periods, and KAM's responses to these comments;
- KAM's responses to information requests from the Agency and EAO;
- Issues raised by Indigenous groups regarding potential impacts of Ajax on Aboriginal Interests, and the responses by KAM, the Agency, the EAO, and federal and provincial departments;
- Reports and recommendations resulting from the SSN Assessment Process, and the decision of the SSN Joint Council on March 4, 2017;
- The design of Ajax as specified in the proposed Certified Project Description (Schedule A of the draft EA Certificate);
- Mitigation measures proposed by KAM, and the proposed EA Certificate conditions (Schedule B, Table of Conditions of the draft EA Certificate); and
- Federal and provincial regulatory authorizations and permits that KAM would be required to obtain.

The Agency and EAO conclude that, taking into account the implementation of mitigation measures and the proposed EA Certificate conditions, Ajax is likely to cause significant adverse residual and cumulative environmental effects to:

- Current use of lands and resources for traditional purposes by aboriginal persons; and
- Heritage.

For other valued components examined under the former Act and BC *Environmental Assessment Act*, the Report concludes that Ajax is not likely to cause significant adverse effects. These conclusions were reached taking into account the implementation of mitigation measures and the proposed conditions that would become legally-binding in the event an EA Certificate is issued.

The Agency and EAO conclude that Ajax would result in adverse impacts on Aboriginal Interests, with the most serious potential impacts on SSN's asserted Aboriginal right to practice cultural and spiritual customs, ceremonies and traditions in the area known as *Pípsell*, which overlaps the mine site.

To verify the accuracy of EA predictions and determine the effectiveness of mitigation measures, if Ajax proceeds, the Agency recommends that follow-up programs be developed and implemented to monitor effects relating to surface and groundwater, fish and fish habitat, vegetation, wildlife, air quality, human health, current use of lands and resources for traditional purposes, and heritage (See Appendix E). The EAO is proposing conditions, which would become legally-binding should Ajax receive a provincial EA Certificate, many of which include monitoring and management requirements.

Following the public comment period on the Report, the federal and provincial ministers will make their respective decisions on Ajax. During this comment period on the Report, the EAO will also consult the public on the draft Summary Assessment Report, draft proposed EA certificate conditions, draft EA Certificate and proposed Certified Project Description.

The federal Minister of Environment and Climate Change will, after considering the Report and comments received in relation to the Report, decide whether, taking into account the implementation of mitigation measures, Ajax is likely to cause significant adverse environmental effects. The EA will then be referred back to the responsible authorities, DFO and NRCan, for an appropriate course of action in accordance with section 37 of the former Act.

The provincial Minister of Environment and Minister of Energy, Mines and Petroleum Resources may consider the Report (as required under section 17(3) of the provincial Act), the Summary Assessment Report and other accompanying materials, as well as any other matters that they consider relevant to the public interest, in making their decision on whether to issue or refuse to issue an EA Certificate, or to order that further assessment be carried out.

31 Appendices

APPENDIX A SUMMARY OF EFFECTS ASSESSMENT OF THE AGENCY AND EAO

EFFECTS RATING CRITERIA

Effects Rating Criteria
All Valued Components

Geographic Extent:

Refers to the how far the potential adverse effect may reach.

- Site-specific: The effect is limited to the Ajax footprint.
- Local: The effect is limited to the local study area.
- Regional: The effect occurs throughout the regional study area.
- Beyond Regional: The effect extends beyond the regional study area.

Duration:

Refers to the length of time the effect lasts.

- Short-term: The effect is restricted to the construction phase.
- Medium-term: The effect extends through the duration of construction and operations.
- Long-term: The effect extends into decommissioning and closure.
- Far future: The effect extends into post-closure.

Frequency:

Refers to the how often the potential adverse effect may occur.

- Once: The effect is confined to one discrete period in time during the life of Ajax.
- Sporadic: The effect occurs at sporadic or intermittent intervals during any phase of Ajax.
- Regular: The effect occurs regularly during any phase of Ajax.
- Continuous: The effect occurs constantly during any phase of Ajax.

Reversibility:

Refers to the degree to which the potential adverse effect is reversible.

- Reversible: The effect can be reversed to baseline conditions.
- Irreversible: The effect cannot be reversed to baseline conditions (i.e. is permanent).

Likelihood:

Refers to the probability of an effect occurring.

- Low: The effect is unlikely to occur (as in a malfunction or accident or other low probability event).
- Medium: The effect may occur, depending on the effectiveness of mitigation measures.
- High: The effect will occur should Ajax proceed.

Confidence:

Refers to the level of confidence in the assessment and significance determination.

- Low: There is a low degree of certainty based on the data provided and the analytical techniques used to support the assessment.
- Moderate: There is a moderate degree of certainty based on the data provided and the analytical techniques used to support the assessment.
- High: There is a high degree of certainty based on the data provided and the analytical

Effects Rating Criteria

techniques used to support the assessment.

Surface Water Quality and Quantity; Groundwater Quality and Quantity; Fish and Fish Habitat; Vegetation; Wildlife; Air Quality; Noise and Vibration; Human Health; Community Well-being; Recreation; Accommodation, Infrastructure, Public Facilities and Services; Local and Regional Economy; Land and Resource Use; and Property Values

Magnitude:

Refers to the severity of the residual effect.

- Negligible: There is no detectable change from baseline conditions.
- Low: The effect results in conditions that differ from the average value for baseline conditions, but remain within the range of natural variation and below a guideline or threshold value, where applicable.
- Medium: The effect results in conditions that differ measurably from the average value for baseline conditions and are equal to or slightly above the limits of natural variation, and/or are equal to or slightly above a guideline or threshold value, where applicable.
- High: The effect results in conditions that differ substantially from baseline conditions, resulting in a clearly detectable change beyond the range of natural variation, and/or are measurable beyond a guideline or threshold value or at a regional population level, where applicable.

Greenhouse Gases

Magnitude:

Refers to the severity of the residual effect.

- Negligible: No measurable contribution to provincial or national emissions. Very little or no measurable change based on comparison with national and provincial inventories.
- Low: Emissions represent a small contribution to provincial or national emissions.
- Medium: Emissions represent a moderate contribution to provincial or national emissions but are within regulatory limits and objectives.
- High: Emissions cause exceedances of provincial or national emissions objectives or standards.

Current Use of Lands and Resources for Traditional Purposes

Magnitude:

Refers to the severity of the residual effect.

- Negligible: No measurable change
- Low: Very small detectable change from baseline; no exacerbation of existing conditions. Little to no alteration of behaviour is required to carry out current use.
- Medium: Varies from baseline and may result in noticeable changes to current use. At least some behaviours are altered at least some of the time while carrying out current use.
- High: Varies from baseline to a high degree; the current use can no longer be carried out in preferred locations and ways.

Effects Rating Criteria

Heritage

Magnitude:

Refers to the severity of the residual effect.

- Negligible: No detectable changes to heritage or archaeology sites.
- Minor: There are detectable changes to heritage or archaeology sites, but limited to small portions of sites of low significance, or portions of sites of higher significance that are already substantially disturbed.
- Medium: Changes to small but intact portions of heritage or archaeological sites of moderate or high significance, or substantial and intact portions of sites of low significance.
- High: Changes to substantial and intact heritage or archaeology sites of moderate or high significance.

SUMMARY OF THE AGENCY AND EAO'S ASSESSMENT OF RESIDUAL EFFECTS AFTER MITIGATION

Section 2 – Surface Water Quality and Quantity Residual Effects after Mitigation

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Surface Water Quality		
Humphrey Creek Increased concentrations of aluminum, arsenic, copper, iron, molybdenum, nitrate and selenium in surface water in Humphrey Creek	• Magnitude: Medium to High • Extent: Local • Duration: Far future • Frequency: Regular • Reversibility: Irreversible • Likelihood: Moderate	The adverse residual effect on surface water quality in Humphrey Creek would be medium in magnitude for all parameters, except for selenium and aluminum which would be high in magnitude, as these parameters were predicted to measurably exceed guidelines for most water quality scenarios assessed. The effect would occur locally (within 500 m of project infrastructure) and would persist through the life of Ajax (far future). The effect would occur regularly and the concentrations would vary depending on the time of year; for many parameters, concentrations would increase during periods of low flow in the winter. The effect would be irreversible, but would decrease in magnitude with time, since reclamation of mine facilities would reduce the source loading which would partially reverse the effect. There is a moderate likelihood of the residual effect occurring, since some amount of contact water is likely to seep or migrate from mine facilities to Humphrey Creek, which would impact water quality.
Lower Peterson Creek Increased concentrations of aluminum, antimony, arsenic, chloride, copper, iron, molybdenum, nitrate, selenium, sulphate and	• Magnitude: Medium to High • Extent: Local • Duration: Far future • Frequency: Regular • Reversibility: Irreversible	The adverse residual effect on surface water quality in lower Peterson Creek would be medium in magnitude for all parameters, except high in magnitude for sulphate and selenium, as these parameters were predicted to measurably exceed guidelines for most water quality scenarios assessed. The effect would occur within the Peterson Creek watershed, within the local study area, and would persist through the life of Ajax (far future). The effect would occur regularly and the concentrations would vary depending on the time of year; for many parameters, concentrations

uranium in surface water in lower Peterson Creek	- Likelihood: Moderate	would increase during periods of low flow in the winter. The effect would be irreversible, but would decrease in magnitude with time, since reclamation of mine facilities would reduce the source loading which would partially reverse the effect. There is a moderate likelihood of the residual effect occurring, since some amount of contact water is likely to seep or migrate from mine facilities to Peterson Creek, which would impact water quality.
Significance	- Not significant	The Agency and EAO conclude that Ajax is not likely to result in significant adverse environmental effects to surface water quality.
Confidence	- Low to moderate	The Agency and EAO consider that there are uncertainties in KAM's water quality modelling related to the quality of the inputs and assumptions used in the model, including the dustfall inputs, baseline water chemistry, hydrological inputs, and geochemical source terms; however, the Agency and EAO also find that there are multiple layers of conservatism in the modelling and that the modelling was appropriate for the EA. There are uncertainties associated with the potential effects to ecological receptors from predicted parameters concentrations, particularly selenium, sulphate, and aluminum. The Agency and EAO note the uncertainties with respect to the behaviour of parameters in the environment, and note that selenium has the potential to bio-accumulate and move through the food chain. There are also uncertainties with respect to the presence of receptors and the effects of timing and duration of predicted elevated parameter concentrations. The significance determination for surface water quality is made with a low to moderate level of confidence, based on KAM's water quality modelling, the quality of the inputs and assumptions in the surface water quality assessment, and the uncertainties with respect to the effects on ecological receptors, including the presence of those receptors, the behaviour of parameters in the environment, and the timing and duration over which elevated concentrations are predicted to occur.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Surface Water Quantity		
Reduced streamflows in upper and lower Peterson Creek, and reduced inflows to Jacko Lake	• Magnitude: Low • Extent: Local • Duration: Far future • Frequency: Continuous • Reversibility: Irreversible • Likelihood: High	In consideration of the conceptual streamflow mitigation plan and the proposed EA Certificate condition that would require KAM to develop and implement an acceptable long-term streamflow mitigation strategy, the Agency and EAO consider that Ajax would be able to maintain close to existing streamflows in Peterson Creek and that the residual effect after mitigation would be low in magnitude. The effect would be local in extent, as it would be felt within the local study area. The effect would be far future in duration and continuous, as it would persist continuously through all project phases. It would be irreversible, given the permanency of Project facilities that would change the flow patterns of the watershed. The likelihood of the effect occurring is high, since development of mine facilities is likely to reduce the available watershed area, which would reduce streamflows.
Significance	• Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to surface water quantity.
Confidence	• Moderate	There are uncertainties regarding the feasibility of a long-term management approach for streamflow losses in Peterson Creek that does not involve pumping from Kamloops Lake in the post-closure. The significance determination for surface water quantity is made with a moderate level of confidence based on the effectiveness of proposed mitigation measures and the long-term streamflow management strategy. Should Ajax proceed, monitoring and management of streamflows in Peterson Creek would be required throughout the life of Ajax to meet ecological needs and to maintain water supply for water licence holders, including adaptive management actions if required.

Potential Residual Effects	Characterization of Residuall Effects	Conclusion and Rationale
Groundwater Quality		
Increase in the concentration of fluoride, sulphate, copper, iron, manganese, molybdenum and zinc in groundwater in the vicinity of Ajax	• Magnitude: Medium • Extent: Local • Duration: Far future • Frequency: Continuous • Reversibility: Irreversible • Likelihood: Moderate	The adverse residual effect on groundwater quality at Ajax would be medium in magnitude, since predicted concentrations of these parameters at the RES-2 well exceeded relevant guidelines, but are within the range of natural variation. The Agency and EAO note that concentrations of these parameters are also elevated in baseline conditions. The extent of the residual effect would be local as it would be experienced within the local study area. The effect would be far future in duration and would persist continuously through the life of Ajax. The effect would be irreversible, but would decrease in magnitude with time, since reclamation of mine facilities would reduce the source loading which would partially reverse the effect. There is a moderate likelihood of the residual effect occurring, since some amount of uncaptured seepage of contact water from mine facilities is likely to migrate to groundwater.
Significance	Not applicable – see rationale	The Agency and EAO assessed groundwater quality as a pathway valued component. Changes in groundwater quality the potential to affect ecological and socio-economic values, as well as humans, which are the ultimate receptors. The results of the groundwater quality assessment inform the assessments and significance determinations of the following valued component assessments: surface water (section 2), fish and fish habitat (section 4), land and resource use (section 15), and human health (section 10).
Confidence	• Moderate	Uncertainties were identified during the EA related to KAM's groundwater quality modelling and selection of the RES-2 well as a proxy for assessing effects to groundwater quality from Ajax. There were also uncertainties identified with the interpretation of the hydrogeology of the Ajax area, and

		groundwater conceptual and numerical models that supported the assessment. The Agency and EAO have a moderate level of confidence in the effects assessment based on KAM's groundwater quality modelling results and the analytical techniques used to support the assessment.
Potential Residual Effects	**Characterization of Residual Effects**	**Conclusion and Rationale**
Groundwater Quantity		
Change in local groundwater balance, including decreased groundwater elevations and changes in groundwater recharge and discharge	• Magnitude: High • Extent: Local • Duration: Far future • Frequency: Continuous • Reversibility: Irreversible • Likelihood: High	The magnitude of residual effects is considered high because Ajax is expected to decrease groundwater elevations by more than 100 m near the pit and increase groundwater elevations by more than 100 m near the tailings storage facility in the post-closure phase (compared to existing conditions), resulting in changes to recharge and discharge within 2 km of project facilities that are beyond the range of natural variation. While the extent of the effect would be limited to within 2 km of project facilities, the magnitude would decrease with distance from the open pit and the tailings storage facility; beyond approximately 2 km from these facilities, the changes in groundwater elevation are predicted to be less than 1 m. The effects are considered far future in duration and continuous, as they would persist continuously into the post-closure phase. They are irreversible, given the permanency of project facilities that would change the hydrogeological characteristics of the Ajax area. The likelihood of the effect occurring is high, since development of project facilities, especially the open pit and the tailings storage facility, is expected to alter the movement of groundwater in the Ajax area. Although the predicted residual effects to groundwater quantity are high in magnitude, would persist into post-closure, are irreversible and continuous, they are predicted to be limited to approximately 2 km from project facilities, where there are four registered groundwater wells that would potentially require deepening or relocating. No effects

		on groundwater elevations are predicted for the Aberdeen area.
Significance	- Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse effects to groundwater quantity.
Confidence	- Moderate	Uncertainties were identified in the EA related to the groundwater conceptual and numerical models, and interpretation of the hydrogeology of the Ajax area, particularly the potential influence of the Edith Lake fault zone and interactions between Jacko Lake and the open pit on groundwater movement. A number of sensitivity analyses were performed to reduce the uncertainties and provide a better understanding of the range of variability. Monitoring and management of groundwater movement in the Ajax area would be required throughout the life of Ajax in order to verify and adaptively manage effects, which may include application of additional mitigation measures. The significance determination for groundwater quantity is made with a moderate level of confidence, based on the effectiveness of proposed mitigation and monitoring measures, additional hydrogeological investigations, and compliance with the proposed EA Certificate conditions.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Habitat Loss	• Magnitude: Low • Extent: Local • Duration: Long-term to Far-future • Frequency: Once • Reversibility: Reversible • Likelihood: High	The Fish Habitat and Fishery Offsetting plan would replace lost habitat by creating and/or enhancing fish habitat in the west arm of Jacko Lake, and sections of Peterson Creek in order to maintain or improve the productivity of recreational and Aboriginal fisheries, following DFO's *Fisheries Productivity Investment Policy* and *Measures to Avoid Causing Harm to Fish and Fish Habitat*. The final Fish Habitat and Fishery Offsetting plan would be designed with input from SSN, DFO and MFLNR. The loss of fish habitat is limited to the local study area, and would be reversible either during decommissioning and closure, or following successful implementation of the Fish Habitat and Fishery Offsetting plan. The habitat loss resulting from Ajax is unavoidable, so the likelihood of this effect is high.
Fish Mortality	• Magnitude: Low • Extent: Local • Duration: Short-term • Frequency: Regular • Reversibility: Reversible • Likelihood: Low	With implementation of mitigation measures to prevent fish mortality, including fish salvage and site isolation, and installation of the sheet pile dam designed to avoid fish mortality and injury, the residual effects to the Rainbow trout population stocked in Jacko Lake are predicted to be low in magnitude and would not result in a measurable change in the population. Effects are limited to Jacko Lake, and are reversible due to the annual stocking of Rainbow trout. With effective implementation of mitigation and monitoring measures identified in KAM's Fisheries and Aquatic Life Monitoring Plan, the likelihood of fish mortality is predicted to be low.
Significance	• Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to fish and fish

		habitat.
Confidence	• Moderate	The Agency and EAO have a moderate level of confidence in the effects assessment based on the uncertainties related to the effectiveness of KAM's proposed mitigation and offsetting measures (e.g. the proposed Conceptual Fish Habitat and Fishery Offsetting Plan). A Fisheries and Aquatic Life Management and Monitoring Plan would be required as an EA Certificate condition to assess the effectiveness of the proposed mitigation and offsetting measures. DFO was satisfied with the proposed Conceptual Fish Habitat and Fishery Offsetting Plan, and KAM would be required to further refine the plan before applying for an authorization under the *Fisheries Act*.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Grasslands		
Habitat Loss Effects to grasslands as a result of vegetation clearing and site construction (i.e. habitat loss)	• Magnitude: Medium • Extent: Local • Duration: Far Future • Frequency: continuous • Reversibility: Irreversible Likelihood: High	Project construction would result in a loss of 1002 hectares of priority grasslands that would be irreversible as offsets and restoration would not replicate the complexity of soils or ecological conditions that currently exist at Ajax. Grasslands habitat loss (32% in the local study area) would be partially offset over the medium-term by off-site enhancements after 10 years or more and restoration and reclamation following closure, after more than 30 years. Therefore there would be an unmitigated medium magnitude effect lasting at least a decade with the possibility of a longer time lag before grassland enhancements are functional. Direct loss of grasslands would be limited to the infrastructure footprint and the effects would occur continuously. It is certain that grassland habitat loss would occur, should Ajax be built.
Habitat Alteration Effects to grasslands as a result of invasive species	• Magnitude: Low • Extent: Local • Duration: Long-term • Frequency: Sporadic • Reversibility: Reversible • Likelihood: Medium	Given the active management approach proposed by KAM, the magnitude of alteration effects to grasslands that may result from the spread of invasive species are expected to be low. The spread of invasive species would be limited to the infrastructure disturbance area. However, because of the prevalence of invasive species at Ajax, it is anticipated that the potential for effects would be long-term, and that active management would be required for the duration of project operations, decommissioning and closure. Any introduction or spread of invasive plant species would occur sporadically through project development, and their effects may be reversible depending on the success of ongoing active invasive species management.

		The likelihood of the effect occurring, and the severity of the effect from invasive species depends on the success and implementation of mitigation measures. Therefore there is a medium likelihood that invasive species would have a residual effect to grasslands from Ajax.
Significance	- Not significant	The Agency and EAO conclude that Ajax is not likely to cause a significant adverse environmental effect on grasslands.
Confidence	- Moderate	The Agency and EAO have a moderate level of confidence in the significance determination based on KAM's assessment of grassland impacts, including the potential for Ajax's impacts to grasslands to interact with other projects or activities and considering that ongoing management of compensation areas will be required over the long-term. The Agency and EAO consider the confidence in this assessment to be moderate due to the uncertainty that enhancement areas will become ecologically functional during the mine life.
Potential Residual Effects	**Characterization of Residual Effects**	**Conclusion and Rationale**
Wetlands		
Habitat Loss Effects to wetlands and their function as a result of vegetation clearing and site construction	- Magnitude: Medium - Extent: local - Duration: medium-term - Frequency: Continuous - Reversibility: Reversible - Likelihood: High	Ajax would result in a direct loss 29% of wetlands in the local study area, including the loss of red-listed and blue-listed wetlands that support species at risk. KAM would offset for lost wetlands to achieve replacement of their ecological functionality, would be required to construct these offsets promptly to minimize time lag effects between the removal of wetlands and the construction of offsets, and would monitor these on an ongoing basis. The Agency and EAO therefore consider this a medium magnitude effect. The effects of direct loss of wetlands would occur in the local study area of Ajax, extending beyond the footprint in areas where the ground or surface hydrology is altered. Wetland loss would be expected to persist in these areas for the duration of the construction and operation. The effect of wetland loss would occur continuously for at least several years until the ecological functions lost are

		created through compensation. Because lost ecological function would be replaced through offsetting, the effect is considered reversible. It is certain that wetland function loss would occur should Ajax proceed.
Habitat Alteration Effects to wetlands as a result of water quality guideline exceedances for metals or due to invasive species.	• Magnitude: Low • Extent: Local • Duration: Far future • Frequency: Sporadic • Reversibility: Reversible • Likelihood: Medium	Given the active management approach proposed by KAM for both management of metals in water and for invasive species, the magnitude of effects to wetlands is expected to be low. The spread of invasive species would be limited to the immediate vicinity of project activities within the local study area. The extent of impacts from metals would be primarily limited to the project footprint, but could migrate, extending away from project activities, particularly in the Peterson Creek drainage. It is anticipated that both water quality as well as invasive species at Ajax would require active management for the duration of project activities and to mine closure, and in the case of metals management into the far future. Any introduction or spread of invasive plant species would occur sporadically through the development of Ajax, as would metal exceedances. Impacts from both on wetlands would be reversible with the implementation of active management. The likelihood of the effect occurring, and the severity of the effect from invasive species and metals in water depends on the success and implementation of mitigation measures. Therefore there is a medium likelihood that invasive species or metal concentrations in water would have an adverse effect on wetlands.
Significance	• Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to wetlands.
Confidence	• High	The Agency and EAO have a high level of confidence in the assessment of effects, and the significance determination based on KAM's assessment of wetland impacts, including the potential for Ajax's impacts to wetlands to interact with

		other projects or activities.
Potential Residual Effects	**Characterization of Residual Effects**	**Conclusion and Rationale**
Rare Plants		
Habitat Loss Effects to vegetation (rare plants) as a result of vegetation clearing and invasive species encroachment	• Magnitude: Medium • Extent: Regional • Duration: Far-future • Frequency: Continuous • Reversibility: Irreversible • Likelihood: High	The Agency and EAO consider the loss of a single occurrence of a given red-listed or blue-listed rare plant species would be a low magnitude effect, if there were data to show that other occurrences of each species were available in the region, however this information is not available for the majority of the rare plants identified in the local study area. The loss of 10 occurrences of a single red-listed plant species would be a medium magnitude effect, as in the case of Sukdorf's broomrape, however it is known that there are at least 20 other occurrences of this plant species within the local study area. Given that regional data are largely unavailable for rare plant species identified at Ajax, a context for these losses is unavailable, and given the uncertainty that proposed mitigation (translocating rare plants or creating conditions that would allow rare plants to re-colonize) would be successful, the Agency and EAO have conservatively considered the combined loss of rare plants at Ajax to be a medium magnitude effect. The direct loss of rare plants would be limited to the infrastructure footprint, but the effect of the loss of the individual plants at the Ajax site could affect rare plant populations and therefore be felt further than the local study area, which has lead the Agency and EAO to assign the effects to a regional extent. Plant loss would occur once as a result of construction activities, and would persist over the long-term extending into the post-closure phases for a potential far-future and continuous effect to some populations of rare plants. Given that rare plants translocation success is uncertain, and that rare plants are unlikely to re-colonize at Ajax post mine

		closure, the loss of rare plants is likely irreversible. It is certain that rare plant habitat loss would occur should Ajax be built, which could affect regional distributions of one or more rare plant species.
Significance	- Not Significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to rare plant populations, which could affect regional distributions of one or more rare plant species.
Confidence	- Low	The Agency and EAO have a low level of confidence in the significance determination based on KAM's assessment of effects to rare plants, including the potential for Ajax's impacts to rare plants to interact with other projects or activities, given the lack of local / regional population data for rare plants. In the absence of complete regional distribution information, the assessment for rare plants is based on a conservative approach. Better regional data may alleviate concerns around rare plants.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Amphibians		
Habitat Loss and Alteration Reduction in available habitat	• Magnitude: Medium • Extent: Local • Duration: Long-term • Frequency: Continuous • Reversibility: Reversible • Likelihood: High	With implementation of mitigation measures to reduce amphibian habitat loss and alteration, KAM's Wetland Offsetting Plan (including wetlands that support amphibian breeding), and active monitoring of the effectiveness of breeding sites to ensure habitat use and population persistence as a component of the Wildlife Management and Monitoring plan, residual effects to amphibians are expected to be medium in magnitude. Residual effects are anticipated to remain below a level that could exceed the resilience and adaptability limits of the population. Amphibians are vulnerable to loss of wetland, and great basin spadefoot would be affected. Ajax would result in the loss of 50% of suitable breeding habitat and the potential alteration of an additional 24% of suitable breeding habitat for great basin spadefoot from the local study area. The extent of the effect is expected to be local, and persist through the life of Ajax (long-term). The effect of habitat loss would occur continuously until replaced wetland habitats are fully functional, which would take several years to achieve. The effect to amphibian populations, particularly species at risk, is expected to be reversible over the long-term, given that the key mitigation measure, wetland compensation, would take several years to achieve full functionality. There is a high likelihood of residual effects due to unavoidable habitat loss and alteration of amphibian habitat. Following successful implementation of habitat offsetting, there is a low likelihood of long-term residual effects.
Exposure to Chemical Hazards Reduction in health and reproductive	• Magnitude: Low • Extent: Local • Duration:	With implementation of mitigation measures to prevent exposure of amphibians to chemical hazards, including removal of vegetation that would attract great basin spadefoot to areas with contact water and installation of diversion pools in known breeding areas, the residual effects on amphibians are predicted to be low in magnitude,

success	Long-term • Frequency: Sporadic • Reversibility: Reversible • Likelihood: Low	resulting in a minor measurable effect on amphibians. The effect is expected to be local in extent, because chemical hazards may affect great basin spadefoot health and reproductive success if they are exposed to contact water seepage near the tailings storage facility or encounter contact water in breeding habitat (i.e. in Humphrey Creek). The potential for exposure to chemical hazards would persist long-term. This effect would, at most, result in sporadic exposure by an individual. The effects would be reversible, as the effects would not happen after the removal of the hazards. With effective implementation of mitigation and monitoring measures identified in the KAM's Wildlife Management and Monitoring Plan and Surface and Groundwater Monitoring and Mitigation Plan, the likelihood of amphibian mortality is predicted to be low.
Direct Mortality Reduction in overall population numbers	• Magnitude: Low • Extent: Site-specific • Duration: Long-term • Frequency: Sporadic • Reversibility: Irreversible • Likelihood: Medium	With implementation of mitigation measures to prevent amphibian mortality, including restricting construction activities to outside the breeding period or salvaging amphibians present during construction, posting wildlife crossing/presence signage and installing barrier fencing along access roads and within the mine site, and installing amphibian crossing structures (e.g. toad tunnels), Ajax is anticipated to result in a minor measurable effect on amphibian population numbers. The residual effect on amphibians is therefore predicted to be low in magnitude. The extent of the effect is expected to be restricted to the Ajax footprint (e.g., site-specific), persist through the life of Ajax (long-term), and occur sporadically during construction and operation phases. The effect would be irreversible because these losses may not be offset by natural recruitment through reproduction and migration. With effective implementation of mitigation and monitoring measures identified in KAM's Wildlife Management and Monitoring Plan, the likelihood of amphibian mortality is predicted to be medium.

Significance	- Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to amphibian populations in the region.
Confidence	- Low to Moderate	The Agency and EAO have a low to moderate level of confidence in the effects assessment for amphibians based on the data provided, uncertainties related to the effectiveness of KAM's proposed mitigation and wetland offsetting measures, including wetlands that would support amphibian breeding. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, as well as the development and implementation of a Wildlife Management and Monitoring Plan.
Potential Residual Effects	**Characterization of Residual Effects**	**Conclusion and Rationale**
Migratory Birds		
Habitat Loss and Alteration (wetlands) Reduction in available habitat	- Magnitude: Medium - Extent: Local - Duration: Long-term - Frequency: Continuous - Reversibility: Reversible - Likelihood: High	With implementation of mitigation measures to reduce wetland-associated migratory bird habitat loss and alteration and KAM's Wetland Offsetting Plan, residual effects to migratory birds are expected to be medium in magnitude. Residual effects are anticipated to remain below a level that could exceed the resilience and adaptability limits of the population. The effect would be local in extent, as Ajax would result in the loss of 34% of wetland habitat, and the potential alteration of an additional 39% of wetland habitat, in the local study area. The extent of the wetland habitat loss is expected to occur in the Ajax footprint, and persist through the life of Ajax (long-term). The effect of habitat loss would occur continuously until replaced wetland habitats are fully functional, which would take several years to achieve. The time lag between loss of wetland habitat and the creation of ecologically functional wetland habitat would render the effects to wetland-associated migratory birds reversible, but over the long-term.

		There is a high likelihood of residual effects to wetland-associated migratory birds due to unavoidable habitat loss and alteration. Following successful implementation of habitat offsetting as part of the Wetlands Compensation Plan, there is a low likelihood of long-term residual effects.
Exposure to Chemical Hazards: Reduction in health and reproductive success	- Magnitude: Low - Extent: Local - Duration: Long-term - Frequency: Sporadic - Reversibility: Reversible - Likelihood: Low	With implementation of mitigation measures to prevent exposure of migratory birds to chemical hazards, including removal of vvegetation that would attract wetland-associated migratory birds to areas with contact water, this residual effect to migratory birds is predicted to be low in magnitude. Residual effects are anticipated to result in a minor measurable effect on local migratory bird population numbers. The EAO is proposing an EA Certificate condition that would require KAM to report on human health risk from Ajax in consideration of monitoring data, including air quality, water quality, soil, plant, and fish tissue monitoring data. The effect is expected to be local in extent, because chemical hazards may affect wetland-associated migratory birds that are exposed to plants that bioaccumulate chemicals of potential concern, such as mercury and selenium, and to water-borne chemicals in drinking water, and if they are exposed to contact water seepage near the tailings storage facility or encounter contact water during stop-overs. The potential for exposure to chemical hazards would persist long-term. This effect would, at most, result in sporadic exposure by an individual. The effects would be reversible, as the effects would not happen after the removal of the hazards. With effective implementation of mitigation and monitoring measures identified in the KAM's Wildlife Management and Monitoring Plan and Surface and Groundwater Monitoring and Mitigation Plan, the likelihood of migratory bird mortality is predicted to be low.
Significance	- Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to migratory bird populations in the region.

Confidence	- Moderate	The Agency and EAO have a moderate level of confidence in the effects assessment for migratory birds based on the data provided, uncertainties related to the effectiveness of KAM's proposed mitigation and wetland offsetting measures. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, as well as the development and implementation of a Wildlife Management and Monitoring Plan.
Potential Residual Effects	**Characterization of Residual Effects**	**Conclusion and Rationale**
Raptors		
Habitat Loss and Alteration Reduction in available habitat	- Magnitude: Medium - Extent: Local - Duration: Far-future - Frequency: Continuous - Reversibility: Reversible - Likelihood: High	With implementation of mitigation measures to reduce raptor habitat loss and alteration and KAM's Grassland Offsetting Plan, residual effects to raptors are expected to be medium in magnitude. Residual effects are anticipated to remain below a level that could exceed the resilience and adaptability limits of raptors. Up to 56% of raptor grassland nesting and foraging habitat, and potential additional alteration of 10%, in the local study area, equates to a loss and alteration of between 5.7-6.7% of suitable available habitat in the regional study area. The effect is expected to be local in extent, as the short-eared owl, rough-legged hawk, great gray owl and Swainson's hawk have a neutral resilience to nesting and foraging habitat loss, and none of these raptor species are dependent on any rare habitat. The effect would persist continuously through the life of Ajax into the post-closure (far-future). The residual effect of habitat loss is expected to be reversible as reclamation and offsetting is expected to create grasslands that would be useful to raptor species. There is a high likelihood of residual effects due to unavoidable raptor nesting and foraging habitat loss. Following successful implementation of grassland habitat offsetting, there is a low likelihood of long-term residual

		effects.
Significance	• Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to raptor populations in the region.
Confidence	• Moderate	The Agency and EAO have a moderate level of confidence in the effects assessment for raptors based on the data provided, uncertainties related to the effectiveness of KAM's proposed mitigation and grassland offsetting measures, including bird nest boxes. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, as well as the development and implementation of a Wildlife Management and Monitoring Plan.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Non-Migratory Game Birds		
Habitat Loss and Alteration Loss of suitable habitat and known lek sites	• Magnitude: Medium • Extent: Local • Duration: Far-future • Frequency: Continuous • Reversibility: Irreversible • Likelihood: High	With implementation of mitigation measures to reduce sharp-tailed grouse habitat loss, KAM's Grassland Restoration and Enhancement Plan and Reclamation and Closure Plan, and commitment to creating replacement lek sites, residual effects to sharp-tailed grouse are expected to be medium in magnitude. Residual effects are anticipated to remain below a level that could exceed the resilience and adaptability limits of the sharp-tailed grouse. The effect is expected to be local in extent, and persist continuously through the life of Ajax into post-closure (far-future). Ajax would result in the functional loss of 50 to 100% of sharp-tailed grouse lek sites in the local study area, which represents 18 to 36% of sites in the regional study area. Depending on the success of the grassland restoration, the adverse residual effect would likely be partially reversible for some grouse habitat requirements. Grouse are particularly vulnerable at lek sites, and the successful use of artificial lek sites is uncertain. Depending on the success of the artificial lek sites, the loss of leks would

		most likely be irreversible. There is a high likelihood of residual effects to sharp-tailed grouse due to unavoidable habitat loss.
Sensory Disturbance Decreased lek usage, or abandonment of nests due to sensory disturbance.	• Magnitude: Medium • Extent: Local • Duration: Long-term • Frequency: Regular • Reversibility: Reversible • Likelihood: High	With implementation of mitigation measures to reduce sensory disturbance on sharp-tailed grouse, KAM's Grassland Restoration and Enhancement Plan and Reclamation and Closure Plan, and commitment to creating replacement lek sites, residual effects to sharp-tailed grouse are expected to be medium in magnitude. Sensory disturbance is anticipated to remain below a level that could exceed the resilience and adaptability limits of the sharp-tailed grouse population. The effect is expected to be local in extent. Although project noise would be generally limited to within 500 m of the footprint, blasting would be heard to a further distance. Sensory disturbance would persist through the life of Ajax (long-term), would occur regularly, but not constantly, and may affect the success / use of artificial lek sites. The effects would be reversible, as the effects would not happen after the removal of the sources sensory disturbance. There is a high likelihood of residual effects due to sensory disturbance, and blasting in particular.
Direct Mortality Reduction in overall population numbers	• Magnitude: Low • Extent: Site-specific • Duration: Long-term • Frequency: Sporadic • Reversibility: Irreversible • Likelihood: Medium	With implementation of mitigation measures to prevent sharp-tailed grouse mortality, including minimizing the mortality of grouse eggs and hatchings by undertaking the clearing and grubbing work outside of the breeding window, and imposing speed limits along mine site roadways, the residual effect to sharp-tailed grouse is predicted to be low in magnitude, resulting in a minor measurable effect on sharp-tailed grouse population numbers. It is expected that the loss of a few individuals within a regional population, may be offset by natural recruitment through reproduction and migration. The extent of the effect is expected to be restricted to the Ajax footprint (site-specific), persist through the life of Ajax (long-term), and occur sporadically during construction and operation phases. The effect would be irreversible because

		these losses may not be offset by natural recruitment through reproduction and migration. With effective implementation of mitigation and monitoring measures identified in the KAM's Wildlife Management and Monitoring Plan, the likelihood of sharp-tailed grouse mortality is predicted to be medium.
Significance	- Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to non-migratory game bird populations in the region.
Confidence	- Low to Moderate	The Agency and EAO have a moderate level of confidence in the effects assessment for non-migratory game birds based on the data provided, uncertainties related to the effectiveness of KAM's proposed mitigation and grassland offsetting measures, including the creation and successful use of artificial sharp-tailed grouse leks. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, as well as the development and implementation of a Wildlife Management and Monitoring Plan.
Potential Residual Effects	**Characterization of Residual Effects**	**Conclusion and Rationale**
American badger		
Habitat Loss and Alteration Reduction in available habitat and dig sites	- Magnitude: Medium - Extent: Local - Duration: Far-Future - Frequency: Continuous - Reversibility: Irreversible - Likelihood:	With implementation of mitigation measures to reduce American badger habitat loss and alteration, including the Grassland Restoration and Enhancement Plan, Landscape Restoration Plan, and Wildlife Management and Monitoring Plan, American badger habitat loss and alteration is expected to be medium in magnitude. Residual effects are anticipated to remain below a level that could exceed the resilience and adaptability limits of American badger. The Agency and EAO note that a large portion of the grassland enhancement proposed is located within approximately 1.5 km of, immediately adjacent to, and on either side of the Coquihalla Highway, south of the interchange with Highway 97, therefore any badgers using these areas could be at a higher risk of road mortality.

	High	The effect is expected to be local in extent, as Ajax would result in a direct loss of up to 50% of the available habitat in the local study area (up to 5% in the regional study area), the majority of which is considered moderate and high suitability habitat for American badger. Ajax would also result in a loss of up to 73% of badger dig sites in the local study area. A loss of prey species in grasslands and loss of dig sites could potentially affect the American badger's reproductive success and reduce protection from predators. The effect would persist through the life of Ajax into post-closure (far future), and the effect would occur continuously. KAM has committed to restoring 2,093 hectares of grasslands until they are self-sustaining. However, both the success of grassland restoration and the utilization of restored grasslands by American badger are uncertain. KAM is proposing to improve badger habitat in areas where badger habitat currently exists. It is not clear that grassland restoration as proposed by KAM will benefit badgers, and they may further impact badgers if they are forced to inhabit these areas given their proximity to roads. There is a high likelihood of residual effects due to unavoidable habitat loss for American badger.
Sensory Disturbance Habitat displacement	• Magnitude: Low • Extent: Local • Duration: Long-term • Frequency: Regular • Reversibility: Reversible • Likelihood: Medium	Noise above 108 decibels (i.e. blasting), vehicle traffic, and mine infrastructure lighting have the potential to cause sensory disturbance to American badger and cause displacement from dens. With implementation of mitigation measures to reduce sensory disturbance on American badger, including limiting impulse blasting to the daytime, reducing traffic speeds, and using low sodium lamps, ultraviolet filters, and directional lighting, sensory disturbance is expected to be low in magnitude. Residual effects are anticipated to result in a minor measurable effect on American badger. The effect is expected to be local in extent, although it is anticipated that project noise would be generally limited to within 500 m of the footprint, blasting would be heard at a further distance.

		Sensory disturbance would persist through the life of Ajax (long-term), and would occur regularly, but not constantly. The effects would be reversible, as the effects would not happen after the removal of the sources sensory disturbance. There is a medium likelihood of residual effects due to sensory disturbance, and blasting in particular.
Disruption of movement: disruption / alteration of migration	• Magnitude: Medium • Extent: Local • Duration: Long-term • Frequency: Continuous • Reversibility: Reversible • Likelihood: High	Access and mine roads, transmission line and waterline, and mine site infrastructure have the potential to disrupt and alter American badger migration between suitable habitat features. Project infrastructure could also impose physical or perceived barriers to habitat. With implementation of mitigation measures to reduce disruption of movement on American badger, including pre-construction surveys to collect data on presence and distribution of individuals and inform the grassland restoration program, location and use of burrows, and the need for further mitigation, disruption of movement is expected to be medium in magnitude. Residual effects are anticipated to remain below a level that could exceed the resilience and adaptability limits of American badger population. Barrier effects would be limited to the local study area and would not block access to habitat available in the regional study area. Disruption of movement would persist through the life of Ajax (long-term), and would occur continuously. The effects would be reversible, as the effects would not happen after the removal and reclamation of Ajax infrastructure. There is a high likelihood of residual effects due to, due to unavoidable disruption of movement in the local study area.
Direct Mortality Reduction in overall population numbers	• Magnitude: Medium • Extent: Regional	With implementation of mitigation measures to reduce direct mortality on American badger, including removing vegetation along roadsides to reduce badger/vehicle collisions, limiting speed on access roads and within the mine site, and installing a culvert on Inks Lake Road and at the upgraded interchange, residual effects to American

	- Duration: Long-term - Frequency: Sporadic - Reversibility: Irreversible - Likelihood: High	badger are expected to be medium in magnitude. Residual effects are anticipated to remain below a level that could exceed the resilience and adaptability limits of the American badger population. Given that road mortality is the primary cause of death for badgers in the region, and the proximity of highways to grassland areas proposed to compensate for habitat loss it seems likely that the local population would suffer losses from road morality in the vicinity of and as a result of Ajax. The extent of the effect is expected to be regional, persist through the life of Ajax (long-term), and occur sporadically during construction and operation phases. The effect would be irreversible because these losses may not be offset by natural recruitment through reproduction and migration, and it is not certain how these losses would affect the Thompson Badger Population Unit. With effective implementation of mitigation and monitoring measures identified in the KAM's Wildlife Management and Monitoring Plan, the likelihood of American badger mortality is predicted to be high because KAM could not fully mitigate for road mortality to badgers and it is the primary cause of death in the region.
Significance	- Not Significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse effects to the self-sustaining American badger populations in the region.
Confidence	- Moderate	The Agency and EAO have a moderate level of confidence in the effects assessment for American badger, based on the data provided, uncertainties related to the effectiveness of KAM's proposed mitigation and grassland offsetting measures, and due to potential mortality from mine road or highway traffic adjacent to KAM's grassland habitat creation. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, as well as the development and implementation of a Wildlife Management and Monitoring Plan. Another proposed EA Certificate condition would require

		KAM to provide support for the Province's Badger Recovery Team.
Potential Residual Effects	**Characterization of Residual Effects**	**Conclusion and Rationale**
Bats		
Habitat Loss Reduction in available habitat	• Magnitude: Low • Extent: Site-specific • Duration: Far future • Frequency: Continuous • Reversibility: Reversible • Likelihood: High	With implementation of mitigation measures to reduce bat roosting habitat loss, including conducting pre-construction surveys to determine bat activity and presence at hibernacula and roosting habitat, identifying areas to avoid, and identifying areas to install bat roosting boxes or additional compensation (e.g. creation of hibernacula), habitat loss is expected to be low in magnitude. Residual effects are anticipated to result in a minor measurable effect on bats. Ajax is expected to result in a loss of 22 to 42% of little brown myotis roosting habitat (mature forests) within the local study area; however, this represents a very small, less than 0.008%, loss of similar habitat in the regional study area. Habitat loss that does occur would be limited to the Ajax footprint (site-specific), persist to the far future, and the effect would be continuous. It is anticipated that bats would find similar roosting habitat in adjacent areas, as bats are able to move easily to other areas to forage and roost. The loss of mature forests is reversible, but only in the far future. There is a high likelihood of residual effects to bats due to unavoidable roosting habitat loss.
Exposure to Chemical Hazards Reduction in health and reproductive success	• Magnitude: Low • Extent: Local • Duration: Long-term • Frequency: Sporadic	Chemical hazards may affect bats that are exposed to water-borne chemicals in drinking water or feed on insects exposed to contact water. Bats could also be exposed to contact water. With implementation of mitigation measures to prevent exposure of bats to chemical hazards, including using duckweed or netting to dissuade bats, and in particular little brown myotis, from using contaminated waterbodies for drinking water, the residual effects to bats is predicted to be

	- Reversibility: Reversible - Likelihood: Low	low in magnitude. Residual effects are anticipated to result in a minor measurable effect on bats. The effect is expected to be local in extent. The potential for exposure to chemical hazards would persist long-term. This effect would, at most, result in sporadic exposure by an individual. The effects would be reversible, as the effects would not happen after the removal of the hazards. With effective implementation of mitigation and monitoring measures identified in the KAM's Wildlife Management and Monitoring Plan and Surface and Groundwater Monitoring and Mitigation Plan, the likelihood of exposure of bats to chemical hazards is predicted to be low.
Significance	- Not significant	The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to bat populations in the region.
Confidence	- Moderate	The Agency and EAO have a moderate level of confidence in the effects assessment bats based on the data provided, and uncertainties related to the effectiveness of KAM's proposed mitigation measures. Pre-construction surveys and monitoring would be required as part of the EA Certificate conditions, as well as the development and implementation of a Wildlife Management and Monitoring Plan.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Increase in atmospheric GHGs	Magnitude: Low Geographic extent: Global Duration: Far future Reversibility: Irreversible Likelihood: High	The Agency and EAO consider that Ajax's GHGs would represent a small contribution to provincial and national emissions during both construction and operation. Ajax would not cause exceedances of regulatory limits or objectives. Emissions are comparable to other mining projects in BC. The effect would be global in geographic extent, far future in duration because GHGs are persistent in the atmosphere, and irreversible. The likelihood of Ajax increasing atmospheric GHG is high.
Significance	Not Significant	The Agency and EAO conclude that Ajax is not likely to be a significant contributor to GHGs emitted within BC or Canada.
Confidence	High	The Agency and EAO have a high level of confidence in the effects determination based on the data provided by KAM and the analytical techniques used to support the assessment.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Increase in ground-level concentrations of criteria air contaminants (TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO) and dustfall	• Magnitude: Medium to High • Extent: Regional • Duration: Long-term • Frequency: Sporadic • Reversibility: Reversible • Likelihood: High	The Agency and EAO consider that Ajax would cause increases in ground-level CAC concentrations that would result in measurable exceedances of particulate matter concentrations in the areas closest to the mine. Ajax would also result in occasional periods of very high levels of dust and particulate matter during high wind events (dust storms), mostly during the summertime. The duration of the effects would be long-term, extending through the construction and operation phases, into the start of the decommissioning phase. The effects in the decommissioning and closure phase are expected to be much lower in magnitude. The duration of dust storm episodes would be short-term and would generally last less than an hour. The effects would be experienced within the regional study area, but are expected to be greatest near the mine site. The effects would be reversible following decommissioning and closure, as ambient air quality levels would be expected to recover to baseline conditions after project closure. Project activities that generate emissions would occur on a regular basis; therefore, the frequency of emissions would be regular. However, the meteorological conditions that exacerbate air quality effects (for example, high winds or poor dispersion conditions) would be experienced on some days throughout the year. Periods of degraded air quality could be experienced on a sporadic basis, depending on a combination of project activities and meteorological conditions. Dust storms would be primarily experienced during dry, windy conditions in the summertime. There is a high likelihood of residual effects, since mining activities inherently produce emissions. The likelihood of occurrence of a short-term, high-intensity event is also high, since these events, including dust storms, are known to already occur in the region.

Increase in exceedances of BC Ambient Air Quality Objective for 24-hour average PM_{10} in upper Aberdeen	- Magnitude: Medium to High - Extent: Regional - Duration: Long-term - Frequency: Sporadic - Reversibility: Reversible - Likelihood: High	Project-related increases in concentrations of ground-level PM_{10} would cause measurable exceedances of the BC Ambient Air Quality Objective for 24-hour average PM_{10} in upper Aberdeen for approximately 7 to 21 days per year, predominantly during poor dispersion conditions in the winter. The number of exceedances per year is expected to be closer to the upper bound of this range, but could possibly be higher. The maximum concentration that could be experienced on these days would be approximately twice the provincial objective at the lower end of this range, and would increase linearly with reduction in mitigation effectiveness. The effect would be experienced within the regional study area, but is expected to be greatest near the mine site. The duration would be long-term, extending through the construction and operation phases, into the start of the decommissioning phase. The effect in the decommissioning and closure phase is expected to be much lower in magnitude, resulting in less exceedances. Project activities that generate emissions would occur on a regular basis; therefore, the frequency of emissions would be regular. However, the meteorological conditions that exacerbate air quality effects (for example, poor dispersion conditions) would be experienced on some days throughout the year. Exceedances of the provincial objective for 24-hour average PM_{10} would be experienced on a sporadic basis, depending on a combination of project activities and meteorological conditions, and would typically be associated with poor dispersion conditions in the winter. The effect would be reversible following decommissioning and closure, as ambient air quality levels would be expected to recover to baseline conditions after project closure. There is a high likelihood that the residual effect would occur to some extent, since mining activities inherently produce emissions.
Significance	Not applicable – see rationale	The Agency and EAO evaluated and characterized changes to air quality as a pathway component. Changes in air quality have the potential to affect ecological, socio-economic, and

		health values, which are the ultimate receptors. The results of the air quality assessment inform the assessment and the significance determinations for the following valued component assessments: surface water (section 2), vegetation (section 5), property values (section 16), and human health (section 10).
Confidence	- Low to moderate	The Agency and EAO have a low to moderate level of confidence in the effects assessment based on the uncertainties related to the emission factors, the effectiveness of proposed mitigation measures and the limitations of the air dispersion model. The air quality assessment was based on a provincially-approved air dispersion modelling approach, consistent with the BC Air Dispersion Modelling Guidelines. However, there are large uncertainties associated with modelling of fugitive dust emissions from Ajax. The sensitivity analyses and updated modelling results that KAM undertook during the review period provided the Agency and EAO with a better understanding of the range of potential effects to air quality. The level of confidence in KAM's ability to monitor and adaptively manage air quality at Ajax was strengthened by the additional details that KAM provided regarding the approach to monitoring, mitigation, and contingency planning in the updated Fugitive Dust Management Plan. However, the Agency and EAO conclude that the overall level of confidence in the air quality effects assessment is low to moderate based on the multiple sources of uncertainty identified during the review. Should Ajax proceed, rigorous monitoring during all phases would be critical to verify predictions and enable pre-determined adaptive management actions if required. KAM would be required to undertake more detailed work, including further development of the monitoring and management plan, before applying for permits under the *Mines Act* and the *Environmental Management Act.*

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Potential to disrupt or annoy residents	• Magnitude: Negligible to Medium • Extent: Local • Duration: Medium term • Frequency: Infrequent • Reversibility: Reversible • Likelihood: Low to medium	The Agency and EAO anticipate negligible to medium magnitude noise effects for residents within the Kamloops City limits including Knutsford; at one residential receptor (#21) noise effects would be low following mitigation; and, at two traditional use sites (TLU3 and TLU9) noise effects with the potential to disrupt or annoy would be medium in magnitude. Overall the noise effects would be audible (infrequently) throughout the local study area, would diminish with increasing distance from the source, and would reverse upon decommissioning and closure. The likelihood of effects are low since mitigation is expected to be effective in addressing noise impacts in general. The two traditional use sites would have a medium likelihood of effect.
Potential to disrupt sleep	• Magnitude: Negligible to Medium • Extent: local • Duration: Medium term • Frequency: Sporadic to Regular • Reversibility: Reversible • Likelihood: Low	Noise emissions associated with mine activities at night would result in a negligible or low magnitude sleep disturbance effect for residents within the Kamloops City limits including Knutsford. The magnitude of potential sleep disturbance is considered medium for those residences at or near receptor #8. The frequency of sleep disturbance will be contingent on the phase and daily operations of the mine; regular effects would occur when mobile equipment activity is in close proximity to rural residences. Overall nighttime noise effects would be audible sporadically throughout the local study area, would diminish with increasing distance from the source, and would be reversible upon decommissioning and closure. The likelihood of effects is low considering that the WHO Sleep Disturbance guidelines are conservative and the exceedances at the rural residence receptors are minimal. For more urban properties mitigation is expected to be

		effective in addressing night time noise impacts in general.
Significance	• Not Applicable – See rationale	The Agency and EAO evaluated changes to noise and vibration as a pathway valued component. Changes in noise and vibration have the potential to affect ecological, social and economic values, as well as human health, which are the ultimate receptors. The results of the noise and vibration assessment inform the assessment and the significance determinations for the following valued component assessments: fish and fish habitat (section 4), wildlife (section 6), human health (section 10), land and resource use (section 15), current use of lands and resources for traditional purposes (section 18), and property values (section 16).
Confidence	• Moderate	The Agency and EAO have a moderate level of confidence in this effects assessment based on the data provided by KAM and the analytical techniques used to support the assessment. The EAO notes that KAM's noise assessment required assumptions about the mine activities that may not capture all noise sources and/or combinations of noise emissions.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Increase in human health risk and potential health effects associated with inhalation exposures to $PM_{2.5}$ and PM_{10}	- Magnitude: Medium - Extent: Local - Duration: Long-term - Frequency: Sporadic ($PM_{2.5}$) to Regular (PM_{10}) (exceedances of toxicity reference value) - Reversibility: Irreversible - Likelihood: High	The respective health risks for $PM_{2.5}$ and PM_{10} due to a change in air quality resulting from Ajax are medium in magnitude since concentrations differ, sometimes substantially, from the average value for baseline conditions. Dust exceedances would occur sporadically ($PM_{2.5}$) to regularly (PM_{10}) throughout the life of Ajax (long-term), depending on mitigation efficiency and atmospheric conditions. The effects would be limited to the local study area. The predicted effect would be irreversible because changes in health resulting from long term increased exposure to Ajax-related dust may persist once project activities cease. There is a high likelihood this effect would occur, since Ajax would result in emissions of $PM_{2.5}$ and PM_{10}.
Increase in human health risk and potential health effects associated with inhalation exposures to NO_2, SO_2, CO, particulate-bound metals and PAHs	- Magnitude: Low - Extent: Local - Duration: Long-term - Frequency: Sporadic (particulate-bound metals) to Continuous (NO_2, SO_2, CO and PAHs) - Reversibility: Irreversible (NO_2)	Inhalation health risks for SO_2, NO_2, PAHs, and particulate-bound metals due to a change in air quality resulting from Ajax would be low in magnitude, as the predicted toxicity reference values are not exceeded for these COPCs. The effects for these COPCs would be long-term in duration, sporadic (particulate-bound metals) to continuous (NO_2, SO_2, CO and PAHs), and limited to the local study area. The effects of NO_2 would be irreversible because changes in health resulting from long term increased exposure to non-threshold pollutants may persist once project activities cease. There is a high likelihood this effect would occur, since Ajax would result in emissions of NO_2, SO_2, CO, particulate-bound metals and PAHs.

	• Likelihood: High	
Increase in human health risk and potential health effects associated with total direct contact for metals	• Magnitude: Low to Medium • Extent: Local • Duration: Far-future • Frequency: Continuous • Reversibility: irreversible • Likelihood: High	Increases in metal exposure for the direct contact exposure pathway would result in a low to medium magnitude effect, as the HQ is below the risk benchmark of 0.2 or the exceedance does not substantially exceed the benchmark. The predicted effect would be far-future in duration, since any metals released to the environment would remain in perpetuity. The effect would be continuous and irreversible since metals will persist in the environment, and would be limited to the local study area. There is a high likelihood the effect would occur, since Ajax would contribute metals to the environment.
Increase in sleep disturbance due to increased noise levels	• Magnitude: Negligible (residents within Kamloops City limits) to Medium (residents nearby the proposed tailings storage facility) • Extent: Local • Duration:	Noise emissions associated with mine activities at night would result in a negligible magnitude sleep disturbance effect for residents within the Kamloops city limits, including Knutsford, as the modelled noise levels, on average, are at or below the measured baseline. The magnitude of potential sleep disturbance is considered medium for those residences at or near the location of the proposed tailings storage facility, which is outside the Kamloops city limits, as noise could exceed the threshold for sleep disturbance. The effect would be limited to the local study area and would be medium term in duration. The frequency of sleep disturbance is sporadic, as it would be contingent on the night time activities at the mine and would cease upon decommissioning and closure. The effect would be reversible

	Medium term • Frequency: Sporadic • Reversibility: Reversible • Likelihood: Low	as sleep disturbance would cease once the project activities cease. The likelihood of sleep disturbance is low considering that the WHO guidelines are conservative and the exceedance at the rural residence receptor is minimal.
Significance	• Not Significant	While Ajax would result in an increase in $PM_{2.5}$, the CR does not exceed 1.0 for the 90%, 80% and 70% haul road dust mitigation scenarios. Exceedances of PM_{10} due to Ajax are anticipated to be regular, but localized. Ajax would not result in exceedances of toxicity reference values for inhalation of NO_2, SO_2, CO, particulate-bound metals and PAHs. Increases in metal exposure for the direct contact exposure pathway would result in a low to moderate magnitude effect, as the HQ is below the risk benchmark of 0.2 or the exceedance does not substantially exceed the benchmark. There is a low likelihood sleep disturbance would result from project activities. The Agency and EAO conclude that Ajax is not likely to cause significant adverse environmental effects to human health.
Confidence	• Low	The Agency and EAO have a low level of confidence in the effects assessment based on the uncertainties identified during the review. There are uncertainties associated with efficacy of dust mitigation, which has implications for health. Uncertainties resulting from HHRA are linked to uncertainties in toxicological information, sensitive populations, exposure assessment and receptor characteristics. There is also uncertainty related to reliance on modeling to characterize the baseline environment. The overall level of confidence in the health assessment is low based on the multiple sources of uncertainty identified during the review. Rigorous monitoring during all phases of Ajax will be important to verify predictions and enable pre-determined

		adaptive management actions if required.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Changes to visual quality for residents	• Magnitude: Negligible to High • Extent: Regional • Duration: Long term • Frequency: Continuous • Reversibility: Irreversible • Likelihood: High	Most vantage points outlined in the EIS/Application would experience negligible visual quality effects. Medium to high magnitude effects to visual quality would occur at some of the rural vantage points in a progressive fashion as Ajax moved from construction to the final years of operations. Effects would diminish following reclamation and would become less noticeable as rural residents surrounding the most affected viewpoints become accustomed to the modified post closure landscape. The likelihood of effect is high.
Decrease in dark sky quality	• Magnitude: Low to Medium • Extent: Regional • Duration: Medium term • Frequency: Sporadic to Continuous • Reversibility: Reversible • Likelihood: Medium	Low magnitude impacts to dark sky as a result of increase in sky glow are anticipated for the Ajax regional study area. Some properties in close proximity and with a direct line of site of Ajax may experience medium magnitude effects from glare light or haul truck headlights. Dark sky impacts would occur sporadically during construction as industrial lighting may be used, continuously during night time operations, and would be reversed following decommissioning and closure. The likelihood of impact is considered medium assuming KAM's proposed mitigations are effective.
Significance	• Not Significant	The EAO concludes that Ajax would not have significant adverse effects to community well-being as defined and analyzed in this section.
Confidence	• Visual Quality (High)	The EAO has high level of confidence in the visual quality assessment, and a low level of confidence in the dark sky

	- Dark Sky (Low)	assessment.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Reduced angling experience on Jacko Lake	• Magnitude: Medium to High • Extent: Local • Duration: Medium term • Frequency: Continuous • Reversibility: Reversible • Likelihood: High	In terms of the change from current baseline conditions the development of Ajax will have a medium to high magnitude impact to the angling experience on Jacko Lake depending on the daily blasting schedule; zone 3 blasts are likely to have a high magnitude effect. Impacts from noise, dust, changes in water quality are anticipated to be continuous and last throughout construction and operations (medium term), while visual impacts would persist beyond operations. Following decommissioning and closure, the EAO anticipates the recreational fishing experience to improve and that Project effects would largely be reversed although topographic changes would be permanent. The EAO considers the likelihood of effect to be high.
Reduced recreation access near Ajax	• Magnitude: Low • Extent: Local (Site specific) • Duration: Medium term • Frequency: Continuous • Reversibility: Reversible • Likelihood: High	Ajax will have a low magnitude impact to recreational access on goose lake road (site specific), on a continuous basis throughout the life of the mine (medium term) and would be reversed once an alternative route for the road is established. The likelihood of impact to recreational access near Ajax is considered high.
Significance	• Not significant	The EAO concludes that Ajax would not have significant adverse effects to recreation as defined and analyzed in this section.
Confidence	• Moderate	The EAO has a moderate level of confidence in this assessment given the variation in angler preferences and tolerance for disruptions from the current baseline.

Section 13 – Accommodation, Infrastructure, Public Facilities and Services Residual Effects after Mitigation

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Shortage of temporary accommodation due to cost and/or availability.	• Magnitude: Low • Extent: Regional • Duration: Short term • Frequency: Sporadic • Reversibility: Reversible • Likelihood: High	Low magnitude effects on temporary accommodations would occur sporadically (particularly during the summer travel months) over the construction phase (short term) throughout Kamloops. Project effects to accommodation would be reversed following decommissioning and closure. The EAO considers the likelihood of an effect to temporary accommodation high.
Increased demand for police services	• Magnitude: Low • Extent: Regional • Duration: Short term • Frequency: Sporadic • Reversibility: Reversible • Likelihood: moderate	Low magnitude increases in demand for police services would occur on a sporadic basis in Kamloops during Ajax construction as a consequence of potential delinquent behavior of some employees of the Ajax construction workforce. These short term impacts would be reversed during the operations phase once the construction workforce migrates elsewhere for work. Given the offsetting nature of the proposed mitigations and the existing capacity constraints of the Kamloops RCMP the likelihood of residual impact is considered moderate.
Increased traffic demand on transportation infrastructure	• Magnitude: Low • Extent: Local • Duration: Short Term • Frequency:	Low magnitude impacts to transportation infrastructure would occur at the local scale continuously over a 6 month period (short term) while upgrades to interchanges are made. Impacts to local traffic would subside upon completion of the interchanges and would cease during operations, assuming the transportation management plan is effective. The likelihood of effects to transportation

	Sporadic - Reversibility: Reversible - Likelihood: High	infrastructure and traffic is considered high while construction of the interchanges takes place.
Significance	- Not significant	The EAO concludes that Ajax would not have significant adverse effects to accommodation, infrastructure, public facilities and services as defined and analyzed in this section.
Confidence	- Moderate	In consideration of the information produced during the EAO and the EAO has a moderate level of confidence in this assessment.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Labour Competition Increased labour competition for local businesses resulting in increased labour costs and/or labour shortages.	• Magnitude: Low • Extent: Regional • Duration: Medium term • Frequency: Continuous • Reversibility: Reversible • Likelihood: Medium	While project workforce requirements and potential for cumulative labour competition effects from the TMX are expected to be greatest during construction, the magnitude of effect is expected to be low following mitigation. During operations with consideration for continued population growth and project induced in-migration, the magnitude of effect is expected to be negligible. Labour competition effects would affect the regional labour market, would be continuous with possible acute episodes during construction, and would be reversible following decommissioning and closure. A medium likelihood is applied in consideration of KAM's proposed mitigations for increased labour competition.
Significance	• Not significant	The EAO concludes that Ajax would not have significant adverse effects on the local and regional economy.
Confidence	• Moderate	The EAO has a moderate level of confidence in the effects determination given the uncertainties in being able to forecast what labour market conditions will be during project construction.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Limitations on ability local government to achieve land use planning objectives	• Magnitude: Low • Extent: Local • Duration: Medium term • Frequency: Continuous • Reversibility: Reversible • Likelihood: Moderate	The EAO considers that residual impacts to land use objectives would be low magnitude. Constraints to achieving community land use objectives would occur continuously for City lands adjacent to Ajax and would dissipate with distance from the mine. Effects would be most pronounced during operations. At closure the effect would be reversed. The EAO considers the likelihood of effect as moderate given the community's stated concerns about the mine impacts and the uncertainty about how residents and prospective residents of Kamloops might respond to the real and/or perceived impacts to land and resource use near the mine site.
Effects on ranching practices including limitations on access to grazing lands	• Magnitude: Low • Extent: Local • Duration: Medium term • Frequency: Regular • Reversibility: Reversible • Likelihood: High	The magnitude of impacts to ranching practices is considered low given that KAM is committed to negotiating access agreements with neighboring ranches. Effects would extend to adjacent ranches to the Project, would occur at regular intervals depending on the ranchers need for forage, and would be reversible following decommissioning and closure (perhaps earlier in some cases where progressive reclamation allows). Given the proposed closure of Goose Lake Road there is a high likelihood of effect.
Inability of licenced surface water users to receive licenced water volumes	• Magnitude: Medium • Extent: Local • Duration: Far future • Frequency: Sporadic	The magnitude of impacts to affected licensees upstream of Jacko Lake would be medium given the potential for reduced surface water levels that would potentially be inadequate for their irrigation needs. The EAO notes that these licence holders are sometimes not able to draw their allocated amounts under existing low flow conditions. Impacts to groundwater users are considered to be medium magnitude. Effects on licenced water users would occur sporadically depending on seasonal precipitation rates at the affected properties and may not be reversible following closure and

	- Reversibility: Irreversible - Likelihood: Medium	decommissioning. The likelihood of effect is medium given KAM's anticipated mitigations and the EAO's proposed EA Certificate conditions.
Significance	- Not significant	In consideration of the proposed mitigations and the EAO's proposed EA Certificate conditions, the EAO concludes that Ajax would not have significant adverse effects to land and resource use.
Confidence	- Land use objectives: Moderate	The EAO has a moderate level of confidence in the effects determination given the uncertainties in attributing project effects to the ability to achieve land use objectives for local governments.
	- Ranching practices: Moderate	The EAO is moderately confident in this assessment given uncertainties on the outcome of KAM's access negotiations with neighboring ranches.
	- Licenced water users: Low	The EAO has a low level of confidence in the effects determination for agricultural water use given uncertainty about the effectiveness of the proposed surface water and groundwater mitigation measures.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Property Values Downward pressure on property values due to nuisance factor effects of dust deposition, noise and visual aesthetic changes	• Magnitude: Low to Medium • Extent: Local • Duration: Medium term • Frequency: Continuous • Reversibility: Reversible • Likelihood: Low to High	The EAO concludes that the Project would exert up to medium magnitude downward pressure on the value of some rural properties near or adjacent to the mine site depending on the number and severity of overlapping nuisance factors. The Project may exert downward pressure on Aberdeen property values but the magnitude of this effect is considered negligible to low depending on the proximity of the property to the mine site and its relation to prevailing wind directions which influence dust deposition and audibility of noise emissions. The frequency of nuisance effects would be continuous, local in extent (limited to properties in near to the mine), and largely reversible following reclamation. The likelihood of downward pressure on property value for at least two or three neighbouring rural residential properties is high; the likelihood for other properties ranges from low to moderate depending on their proximity to the mine. The EAO notes that Ajax is may exert upward pressure on property values due to project related income and population increases, which could temper Project effects on property values.
Significance	• Not significant	The EAO concludes that Ajax would not have significant adverse effects on local and regional property values.
Confidence	• Low	The EAO has a low level of confidence in the effects determination given the uncertainties relating to forecasting and mitigating project related nuisance effects to property values.

Section 18 – Current Use of Lands and Resources for Traditional Purposes Residual Effects after Mitigation.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Effects on fishing	• Magnitude: High • Geographic Extent: Regional • Duration: far future • Frequency: Continuous throughout, and potentially beyond, the mine life • Reversibility: Irreversible • Likelihood: Medium	Ajax would have residual effects on fishing as SSN would have a reduced ability to carry out their spring trout fishery at Jacko Lake due to the proximity of the mine site. The Agency and EAO consider that the adverse residual effects on the current practice of fishing would be high in magnitude due to the importance of SSN's spring trout fishery in Jacko Lake. The effect is considered regional in extent as the spring trout fishery at *Pípsell* cannot be replicated elsewhere in SSN's asserted traditional territory. The effect would be continuous and far future in duration, as it would occur throughout, and potentially beyond, all phases of Ajax. The effect would be irreversible, due to the loss of opportunities for inter-generational knowledge transfer. There is a moderate likelihood of the residual effect occurring, as there is some uncertainty as to whether SSN members would avoid the fishery due to the perception of contamination and stress to the fish population.
Effect on hunting and plant gathering	• Magnitude: Medium • Geographic Extent: Regional • Duration: Long-term • Frequency: Continuous • Reversibility: Irreversible • Likelihood:	Residual effects on the current practices of hunting and plant gathering would be medium in magnitude as these activities could be carried out in other locations that are further away from the mine site. The effect is considered regional in extent as *Pípsell* has been identified by SSN as a preferred harvesting area within their asserted traditional territory. The effect would be continuous and far future in duration, as it would occur throughout, and potentially beyond, all phases of Ajax. The effect would be irreversible, due to the loss of opportunities for inter-generational knowledge transfer. There is a moderate likelihood of the residual effect occurring, as there is some uncertainty as to the timing and

	Medium	extent that the grasslands affected by Ajax would be successfully reclaimed to pre-Ajax levels.
Effect on cultural and ceremonial uses	- *Magnitude: High* - Geographic Extent: Regional - Duration: Far future - Frequency: Continuous - Reversibility: Irreversible - Likelihood: High	*Ajax would have residual effects on cultural and ceremonial* uses due to the mine site overlapping with *Pípsell*, an area of unique cultural significance to SSN. The Agency and EAO consider that the adverse residual effects on the current cultural and ceremonial practices would be high in magnitude due to the cultural and spiritual significance of *Pípsell* to SSN. The effect is considered regional in extent as *Pípsell* has been identified by SSN as a cultural keystone area, and SSN members would not be able to participate in cultural and ceremonial activities in the same way elsewhere in their asserted traditional territory. The effect would be continuous and last into the far future, as the location of the mine site would permanently alter the physical and spiritual attributes of *Pípsell*. The effect would be irreversible, due to the loss of opportunities for inter-generational knowledge transfer. There is a high likelihood of the residual effect occurring, as the mine site overlaps with *Pípsell*.
Significance	- Significant	The Agency and EAO conclude that Ajax is likely to cause significant adverse environmental effects to the current use of land and resources for traditional purposes by aboriginal persons. Ajax would result in a high level of change, lasting far in the future, in how aboriginal persons carry out their traditional activities in their preferred locations and ways.
Confidence	Moderate to High	The Agency and EAO have a moderate to high level of confidence in the effects assessment, as there is some level of uncertainty as to the extent to which SSN members would avoid the area because of the presence of Ajax. However, there is high confidence that Ajax would overlap with *Pípsell*, which is recognized as a cultural keystone area by SSN.

Potential Residual Effects	Characterization of Residual Effects	Conclusion and Rationale
Effects to archaeological sites	• Magnitude: Medium • Extent: Local • Duration: Far future • Frequency: Once • Reversibility: Irreversible • Likelihood: High	The residual effects to archaeological sites would be medium in magnitude as the effects would be to intact portions of archaeological sites of low and moderate importance. Effects would be local in extent because they would be limited to the Project footprint. Given the non-renewable nature of archaeological sites, the effect would be far future in duration, occur once, and would be irreversible. There is a high likelihood of the residual effect occurring, since archaeological sites are located in the area of proposed infrastructure.
Effects to early settlement heritage sites	• Magnitude: Minor • Extent: Local • Duration: Far future • Frequency: Once • Reversibility: Irreversible • Likelihood: Medium	The residual effects to early settlement heritage sites would be minor/medium in magnitude as the effects would be to substantial and intact portions of sites of low importance. Effects would be local in extent because they would be limited to the Ajax footprint. Given the non-renewable nature of heritage sites, the effect would be far future in duration, occur once, and would be irreversible. There is a moderate likelihood of the residual effect occurring, since heritage sites are located in the local study area and in the vicinity of the proposed infrastructure.
Effects to Indigenous heritage	• Magnitude: High • Extent: Regional • Duration: Far future • Frequency: Once • Reversibility: Irreversible	The Agency and EAO consider that the adverse residual effects to Indigenous heritage would be high in magnitude as the effects would be to a substantial portion of *Pípsell* which is a cultural keystone landscape of very high importance to SSN. Effects would be regional in extent because effects would be felt throughout the SSN community. The effect to Indigenous heritage would be far future in duration, occur once, and would be irreversible. There is a high likelihood of the residual effect occurring,

	- Likelihood: High	because of the certainty that Ajax would disturb key physical components of *Pípsell*, and the strong evidence of the relationship between the physical landscape and SSN cultural integrity.
Significance	Significant	The Agency and EAO considers the residual effects to Indigenous heritage be high in magnitude, because Ajax would affect substantial portions of intact sites of high importance, regional in geographic extent, based on the impact on the entire SSN community, and far future in duration. The Agency and EAO conclude that Ajax is likely to cause significant adverse environmental effects to physical and cultural heritage based on effects to Indigenous heritage.
Confidence	High	The Agency and EAO have a high level of confidence in the significance determination, given that there is high confidence that Ajax would overlap with *Pípsell*, which is recognized as a cultural keystone area by SSN.

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
Alternative General Site Arrangements			
Ajax North	• within two watersheds • Inks Lake used as a TSF seepage pond	• more widely spread footprint • loss of small, unnamed lake beneath the North Waste Dump (NWD) • alteration of Inks Lake for mine water management • visibility and noise concern	
Ajax South	• within one watershed • entirely outside of Kamloops City limits • most infrastructure (e.g. TSF, most of the MRSFs) located further away from the city limits than Ajax North	• tighter footprint • TSF relocated more than 5 km southeast from the previous location, away from Coquihalla Highway • removal of Goose Lake and its access road • north mine rock storage facility and temporary ore stockpiles relocated 3.5 km southeast from the previous location in Ajax North • processing plant, crushers, and temporary ore stockpiles relocated south of the open pit and more than 2 km away from Kamloops • less visible and reduced potential for noise and dust effects	✓
Alternative Mining Methods			
Underground mining	• drilling, blasting, and heavy equipment for extraction of high grade ores underground	• not economically feasible • requires workers with more specialized training • less mine rock production than open pit method • less surface disturbance	
Open pit	• drilling, blasting, and heavy equipment for extraction of ores that extend from the surface to considerable depths	• most economically and technically feasible option • significant local experience • lower incident frequency rate • flexible and highly mechanized	✓
In-situ leaching	• pumping leaching solution into the deposit and pumping the dissolved ore content to the surface	• not technically nor economically feasible • not suitable for sulphide deposits	
Alternative Production Rates			
40 ktpd	• low capital cost but high operating cost • 37 year mine life	• not economically feasible	
60 ktpd	• NPV of US$416 million at	• lower emissions intensity (e.g.	

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	8% discount rate, a 14.5% internal rate of return and 7.8 year pay-back period • 25 year mine life	noise and dust) • lower employment and longer mine life	
65 ktpd	• improved return of investment based on optimization of 60 ktpd plan • 23 year mine life		✓
75 ktpd	• 9% NPV gains relative to the 60 ktpd NPV with estimated capital cost increase of $136 million • 20 year mine life	• small NPV gains for large capital cost increase (larger processing plant and vehicle fleet) • higher peak demand for utilities • increased sizing of equipment/facilities • increased emissions intensity (e.g. noise and dust) • higher employment and shorter mine life • larger footprint	
90 ktpd	• 6% NPV gains relative to the 60 ktpd NPV with estimated capital cost increase of $200 million • 17 year mine life		
	Alternative Open Pit Limits		
Unconstrained pit infringing on Jacko Lake	• largest infringement on Jacko Lake relative to the other alternatives • requires a dam separating the pit from the lake	• accesses entire high grade zone in western parts of the deposit • greatest potential effects on aquatic and terrestrial habitat • potential post-closure flow reductions to Peterson Creek • greatest infringement on Jacko Lake • increase in noise and air emissions • greatest effects on Aboriginal Interests and recreational users • significant offsetting in the local area	
Constrained pit – completely outside of Jacko Lake	• constrained pit completely outside of Jacko Lake	• not economically feasible • unable to access high grade zone • completely avoids Jacko Lake • opportunity cost approximately US$886M and reduces the mineral inventory by about 88Mt and 3.7 years of mine life	
Constrained pit – minimal infringement on Jacko Lake	• infringes on Jacko Lake by removing the northeast arm but preserving the southeast arm • 2 small dams (< 5 m) to hold the probable maximum flood (PMF) and excess water diverted	• accesses part of high grade zone in western parts of the deposit • opportunity cost approximately $334M and reduces the mineral inventory by 44Mt and 1.9 years of mine life • minimizes effects to land and aquatic resource users	✓

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	around the pit • area surrounding the open pit would be reclaimed • rock berm around the open pit perimeter to limit access • Peterson Creek connection at re-established mine closure	• reduction of fish habitat limited to northeast arm of Jacko Lake and less terrestrial habitat disturbance compared to unconstrained open pit • minimizes effects to local community/Indigenous Groups	
Alternative Mine Rock Storages			
North waste dump	• part of the Ajax North general arrangement • several kilometers northwest of the open pit • within Kamloops City boundary, approximately 1.5 km from community of Aberdeen • 450 hectare footprint • 728 Mt storage capacity • 1,084 m elevation	• visible to the Aberdeen community • not close to aquatic habitat • potential noise effects • closest alternative to the highway and residential areas • only alternative within two watersheds	
East waste dump	• part of the Ajax North general arrangement • less than 500 m east of the open pit • approximately 1.5 km from community of Aberdeen • 325 hectare footprint	• visible to the Aberdeen community • potential air quality/noise effects • close to the aquifer associated with glacio-fluvial deposits within the Peterson Creek corridor • one known archaeological site	
South mine rock storage facility	• part of the Ajax South general arrangement • between 1-2 km south of the pit • within 200 m of Humphrey Creek • 210 hectare footprint • 358 Mt capacity • 270 m elevation	• furthest MRSF alternative from Kamloops • reduced opportunity for air/noise emissions • limits potential distribution of runoff from mine rock piles • potential seepage effects to water quality • one known archaeological site within footprint	✓
East mine rock storage facility	• part of the Ajax South general arrangement • accommodate temporary overburden and topsoil stockpiles to be used during reclamation • approximately 1.5 km from community of Aberdeen • only store non-potentially acid generating (NPAG) rock	• lower design height compared to EWD • further from the Peterson Creek aquifer compared to EWD • less potential for air quality/noise/visibility effects • one archaeological site within footprint	✓

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	100 hectare footprint 85 m elevation		
West mine rock storage facility	part of the Ajax South general arrangement most of its alignment constructed north of the North Embankment between 1 to 2 km south of the pit 155 hectare footprint 200 Mt storage capacity 140 m height	requires relocation of Kinder Morgan Canada's TMX pipeline further away from Kamloops than the NWD and EWD provides added buttressing to the TSF embankments limits potential distribution of runoff from mine rock piles reduced opportunity for air/noise emissions two archaeological sites	✓
In-pit mine rock storage facility	part of the Ajax South general arrangement backfill the pit toward the end of mine life up to 200 Mt storage capacity	reduces project's footprint insufficient capacity to manage the volume of mine rock generated timing constraints	✓
Alternative Tailings Storage Facility Locations			
Old Afton TSF (wet tailings)	pumpable located between Highway 5 and Highway 1, approximately 12 km southwest of City of Kamloops, and 9 km west of Ajax utilizes existing Old Afton TSF but requires expansion or construction of a separate facility after approximately 4 years approximately 9 km of pipelines located in an already disturbed area within SSN traditional territory	second lowest cost largest upstream catchment fewest new effects to wildlife habitats limits potential disturbance to heritage resources visible to surrounding communities potential dust, noise, and health issues SSN concerns with safety, dust, and potential effects to the Alkali Creek watershed limits TSF to an existing footprint for approximately four years downstream consequences in the event of a TSF failure with agricultural lands along Cherry Creek, extending to Kamloops Lake	
Old Afton TSF (dry tailings)	stackable	insufficient capacity to contain tailings not technically feasible	
Directly east of Coquihalla Highway (wet tailings)	pumpable	not topographically supported	
Directly east of Coquihalla Highway (dry tailings)	stackable between Lac Le Jeune and Coquihalla highways,	highest capital and operating costs reduces water demand from Kamloops Lake	

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	approximately 3.5 km west of Ajax • approximately 183 m stack height • within SSN traditional territory	• smallest impoundment footprint • highly visible to the community • potential dust and health issues • SSN concerns with dust, loss of Inks Lake, and potential impacts to Alkali Creek Watershed • limited need for water management structures • unproven nature of constructing a stackable facility at unproven rates • potential consequence if a failure were to occur directly next to the Coquihalla highway • limited expansion potential	
North of open pit (wet tailings)	• pumpable	• not topographically supported	
North of open pit (dry tailings)	• stackable	• close proximity to residents	
South of open pit (wet tailings)	• pumpable • approximately 1 km to the southwest of the plant site • tailings pipeline required • construction of up to four embankments • short haul distance from TSF to the open pit • integrates tailings embankment with the MRSF structures • limits project footprint to within one watershed • within SSN traditional territory • Goose Lake encapsulated entirely	• most technically feasible • most economically viable • minimizes water management requirements • least downstream sensitivity • visibility concerns • heritage value concerns • SSN concerns with effects to Peterson Creek and Jacko Lake, and the encapsulation of Goose Lake • downstream consequences in the event of a TSF failure with agricultural lands along Cherry Creek, extending to Kamloops Lake • more opportunity and flexibility for mine rock buttressing to reduce risk of potential breach events • highest level of long-term stability • potentially concentrates water quality effects closer to Jacko Lake and Peterson Creek	✓
South of open pit (dry tailings)	• stackable • filtration system • development of underdrains and a water storage facility • development of Goose	• very high capital and operating costs • reduces water demand from Kamloops Lake • high erosion • frequent ditch and channel	

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	Lake as a water pond with two dams to store up to 3 Mm^3 - limits project footprint to within one watershed - within SSN traditional territory	maintenance required - least downstream sensitivity - heritage value concerns - SSN concerns with effects to Peterson Creek, Jacko Lake, and Goose Lake - SSN concerns with dust generation - Goose Lake not entirely encapsulated with tailings and could potentially be reclaimed during post-closure - close proximity to residential areas, concerns around visibility and dust generation	
East of open pit (wet tailings)	- pumpable	- insufficient capacity to contain tailings - close proximity to the Peterson Creek Aquifer and the community of Knutsford	
East of open pit (dry tailings)	- stackable	- insufficient capacity to contain tailings - close proximity to the Peterson Creek Aquifer and the community of Knutsford	
West of open pit (wet tailings)	- pumpable	- insufficient capacity to contain tailings - complete loss of Jacko Lake and Inks Lake	
West of open pit (dry tailings)	- stackable	- insufficient capacity to contain tailings - complete loss of Jacko Lake and Inks Lake	
Alternative Tailings Facility Technologies and Management			
Conventional un-thickened unbuttressed facility	- conventional tailings pumped to the TSF and discharged from spigots around the perimeter of the facility - highest water content - 700 hectares - 1,060 m - narrow possible beach deposition slopes (1-2%)	- largest footprint - produces most seepage (115 m^3/h) - most challenging to reclaim - largest loss of wildlife habitat - intercepts most surface and groundwater and uses most make-up water - low embankment elevation and does not require night lighting for tailings placement - dust potential reduced but dust generation off beaches similar to dry stack - least physical stability	

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
Conventional un-thickened buttressed facility	• conventional tailings pumped to the TSF and discharged from spigots around the perimeter of the facility • highest water content • 700 hectares • 1,060 m • narrow possible beach deposition slopes (1-2%)	• largest footprint • produces most seepage ($115\ m^3/h$) • most challenging to reclaim • largest loss of wildlife habitat • intercepts most surface and groundwater and uses most make-up water • low embankment elevation and does not require night lighting for tailings placement • dust potential reduced but dust generation off beaches similar to dry stack	
Thickened buttressed facility	• 690 hectares • 1,056 m • steep beach slope (2-5%)	• reduces seepage potential ($36\ m^3/h$) • trafficability improved on beaches and settlement • loss of wildlife habitat and potential wildlife attractant • intercepts slightly less surface and groundwater and uses less make-up water • low embankment elevation and does not require night lighting for tailings placement • minimizes dust potential	✓
Paste buttressed facility	• pumpable (liquefiable) • requires engineered embankment • 603 hectares • 1,095 m • steepest beach slope (3-10%)	• less seepage potential ($< 36m^3/h$) • trafficability limited and reclamation success affected • smaller loss of wildlife habitat than un-thickened or thickened • intercepts slightly less surface and groundwater and uses less make-up water • highest embankment elevation and requires night lighting for tailings placement • least dust potential	
Filtered dry stack tailings	• filtering thickened tailings and using a conveyor to transport filtered material to the TSF • only western portion of the facility has external buttressing with mine rock, other slopes are made from compacted filtered	• smallest footprint • almost no seepage • trafficable and progressively reclaimable • smallest loss of wildlife habitat • least effect on surface and groundwater flow and least make-up water requirement • lowest embankment but requires	

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	tailings material • lowest water content • does not require engineered embankment • 429 hectares • 1,055 m	night lighting for tailings placement • highest dust potential • high maintenance and less system reliability • technology not proven at the planned processing rate of 65,000 tpd • expected to have good stability but would be sensitive to construction methods and water content of the stacked tailings • highest capital and operational costs	
Alternative Tailings Storage Facility Closures			
Small pond/wetland and discharge to open pit	• supernatant tailings process water pumped to the pit and beach areas of the TSF covered with approximately 1 m of mine rock • entire TSF except in the pond area would be covered by an earth fill approximately 1 m thick • seasonally fluctuating pond and wetland would remain in perpetuity in the location of the final supernatant pond • engineered channel to direct any runoff to the open pit	• less expensive than dry cover closure • easier to construct • reduces risk of saturated conditions near any embankments • long term consolidation effects have little effect on the long term performance • no recontouring of the TSF • no modifications to existing water courses • challenging construction of the engineered channel over the east embankment • entire surface of the TSF would be covered in water if long term water balance changes • area of soft sediments may pose a hazard for users • uncapped area of softer sediments will take longer than dry closure options to consolidate • increased seepage from the TSF • concentration of contaminants at closure • area of soft sediments cannot be returned to pre-mining use • less runoff to the environment	
Dry Closure with Discharge to Humphrey Creek	• tailings surface covered and recontoured with an earth fill cover • pass TSF runoff into an engineered channel towards the south of the	• minimizes ponded water within the TSF and infiltration into the tailings • more confidence in achieving than other options • reduced risks and costs associated	✓

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	TSF and into Humphrey Creek	with long-term maintenance and monitoring of embankments • costly to develop channel to Humphrey Creek • requires other mitigation options if TSF runoff quality are not suitable for release to Humphrey Creek • improved discharge water quality • area can be returned, as close as practical, to pre-mining conditions • runoff from reclaimed surface returns directly to creeks • excavation of post-closure channel disturbs terrestrial and aquatic habitat	
Dry closure with discharge to open pit Option 3a	• tailings surface covered and recontoured with an earth fill cover • pass runoff through a spillway along the abutment of the east embankment into the open pit • uses current tailings deposition plan establishes sloped beaches to the south and a supernatant pond away from the embankments	• minimizes ponded water within the TSF and infiltration into the tailings • not economically feasible	
Dry closure with discharge to open pit Option 3b	• tailings surface covered and recontoured with an earth fill cover • pass runoff through a spillway along the abutment of the east embankment into the open pit • alternate tailings deposition plan that develops sloped beaches to the east and establishes a supernatant pond near the east embankment	• minimizes ponded water within the TSF and infiltration into the tailings • minimizes high construction costs incurred in option 3a	
Alternative Water Use and Supplies			
Upgraded system from Kamloops Lake	• approximately 16 km of new pipeline from New Afton Mine to the Ajax processing plant • new intake and pumping	• only alternative sufficient to supply all of Ajax's water demand	✓

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	station at Kamloops Lake • 2 new booster stations along the pipeline • existing New Afton water pipeline between Kamloops Lake and New Afton mine		
Run-off within the TSF catchment	• collects run-off within the TSF catchment that would otherwise be directed around the TSF	• not sufficient to supply all of Ajax's water demand	
Treated effluent from the City of Kamloops	• use treated effluent from the City of Kamloops	• not sufficient to supply all of Ajax's water demand • would not fulfill freshwater demand	
Alternatives of Jacko Lake Management			
Partial containment of the Probable Maximum Flood	• containment of the PMF within Jacko Lake • utilizes Peterson Creek diversion system • requires four dikes less than 5 m high	• potential change in lake flow • potential effects to fish habitat and recreational fishery that can be mitigated • public perception of reduced value of the lake	✓
Release of the Probable Maximum Flood	• discharge a portion of the PMF to the open pit • gravity drainage through an engineered berm or spillway • requires two dams less than 5 m high	• safety risk to open pit • potential disruption of mining activity	
Alternative Peterson Creek Realignments			
North route pipeline	• pump intake located on the northeast end of Jacko Lake for conveyance of flows north of the open pit along the main access road	• simplest to construct • low capital cost ($2.1 M) • does not maintain lake circulation • least disturbance to Jacko Lake	
South route pipeline	• pump intake located on the southeast arm of Jacko Lake for conveyance of flows south of the open pit through the Peterson Creek corridor • route within mine infrastructure corridor	• complex construction • high capital cost ($5.6 M) • maintains lake circulation • disturbance within mining area	
Southwest route pipeline	• pump intake located on the southeast arm of Jacko Lake for conveyance of flows around the west perimeter of Jacko Lake and connecting with the	• high capital cost ($6.5 M) • highest environmental disturbance • excavation of large volumes of material • requires substantial water	

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	main access road - 3.5 km access road required - pipeline to bypass a dam construction site on the west arm of Jacko Lake and cross the access road	management plan	
Southeast route pipeline	- pump intake located on the southeast arm of Jacko Lake for conveyance of flows around the east perimeter of Jacko Lake and connecting with the main access road - approximately 4.5 km pipeline length	- moderate capital cost ($3.3 M) - maintains lake circulation - disturbance within mining area	
South route open channel	- gravity flow diversion through an upgraded spillway on the southeast arm connected to an engineered channel between the open pit and MRSF - channel follows similar alignment to that for the re-established Peterson Creek at the end of mine life - remain after mine closure to enhance riparian habitat - collection ditches adjacent to the diversion channel - safety offset of 30 m to 40 m from the open pit	- moderate cost ($3.4 M) - requires extensive excavation - potential creek contamination - channel would not constitute viable habitat - safety risk from interaction with mining infrastructure	
Gravity discharge in open channel for full length of diversion	- flows from Jacko Lake conveyed through an excavated channel aligned south of the open pit - channel would discharge back to Peterson Creek downstream of the open pit	- greatest cross-contamination risk - gravity discharge alternative with largest excavation volume - highest cost gravity discharge alternative	
Gravity discharge in open channel then into pipeline/culvert	- retains open section of Peterson Creek downstream of the replacement dam and diverting flows into a 2.7 km buried culvert that will discharge to Peterson Creek east of the mine site	- preserves water quality in Peterson Creek - reduced excavation requirements - avoids potential impacts to fishery productivity in the southeast arm of Jacko Lake, direct instream fish habitat loss, and loss of the asserted Aboriginal fishery on	✓

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
		upper Peterson Creek • potential for seepage loss	
Open channel flow followed by pumped pipeline system	• divert flows from Peterson Creek around the south side of the open pit • collected flow pumped to a discharge location in Peterson Creek downstream of the open pit	• protected from surface runoff • potential water supply issues • lowest cost gravity discharge alternative	
	Alternative Product Transport Methods and Routes		
Trucking	• accepted standard practice • trucking from mine site to Port of Vancouver	• higher vehicle traffic and increase in air emissions • less potential for spillage • shortest transit time • less material handling	✓
Rail	• rail transport from Kamloops to Port of Vancouver • requires new reload facility with a 2 hectare footprint at Kamloops rail yard	• lower air emissions than trucking • multiple handling requirements • inconsistent scheduling of rail cars • lengthier transit time • increases project footprint • lowest transportation costs	
Combined truck/rail	• truck transport from the mine site to Ashcroft and rail transport to Port of Vancouver	• not economically feasible • some air emissions but lower than trucking • multiple handling	
	Alternative Site Access Roads		
All new interchange	• new ramps extend north and south of the mine access road • one-way and off-ramps end in stop control prior to intersection conflict points • does not use existing public roads • closes mine access road to the west of the new interchange and existing ramps at Inks Lake interchange	• north ramp in previously undisturbed area • better vehicle safety	✓
Full upgrade of Inks Lake interchange	• new ramps all south of the mine access road • two-way connector roads and one way ramps	• same location as existing interchange • less safe for vehicles	
	Alternative Explosives Manufacture and Storage Facilities		
Location between open pit and the east mine rock storage facility	• located behind mine access gate • 150 m east of the open pit	• does not meet the standard for minimum distances to vulnerable infrastructure, as set out in the National Standard of Canada,	

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
		CAN/BNQ 2910-510/2015, Explosives-Quantity Distances • less dust generation and terrestrial habitat disturbance • shorter access road	
Location 4.5 km northwest of pit	• located off the haul road, approximately 4.5 km northwest of the pit	• no permit variation required • more dust generation and terrestrial habitat disturbance • longer access road	✓
Alternative Blasting Schedules			
Year round	• blasting occurs year round • provides continuous feedstock to the mill	• lower capital and operating costs • consistent employment • fewer schedule risks from winter conditions • increased risk of dusting on Jacko Lake	✓
Winter only	• blasting only occurs during the winter season • increased vehicle fleet and larger stockpile area • higher frequency of blasting/day	• higher capital and operating costs • seasonal mining jobs • more schedule risks from winter conditions • greater frequency of noise generation per day over a shorter duration • potentially more dust generation • reduced risk of dusting on Jacko Lake • reduced impact to fishing experience	
Alternative Power Supply and Transmission Line			
BC Hydro	• electric power supplied from existing 230 kV transmission line 9 km east of the Ajax area • constructed within a corridor approximately 10 m wide from the tie-in location to the process plant along the eastern boundary of Ajax • Power line constructed using single wooden poles with some H-frame structures • power supply stepped down to 25 kV at a substation adjacent to the plant	• very high reliability level • lowest costs per megawatt hour • very low air emissions during construction of transmission line but could be minimized with standard mitigation • less than 1 hectare footprint excluding transmission line	✓
Natural gas	• provide firm and backup power or provide only firm	• increase in air and noise emissions but could be minimized with	✓

Project Component / Alternative Mean	Description	Key Considerations Including Potential Adverse Effects	Preferred Alternative
	power with BC Hydro grid providing backup power	standard mitigation - less than 5 hectare footprint excluding pipeline corridor - increase in water demand	
Diesel	- diesel generators for backup power	- intermittent power - high operating costs - increase in air and noise emissions but could be minimized with standard mitigation	✓
Geothermal	- geothermal power plant to provide continuous supply	- high cost - limited resources available	
Wind	- backed up by other firm on-site generation	- high cost - intermittent supply and would not meet project needs	
Solar	- power generated during day time and is dependent upon sunlight availability - has to be backed up by other firm on-site generation	- very high cost - supply would not meet project needs	
Small hydro	- power output depends on water flow	- high cost - intermittent supply and would not meet project needs	
Biomass	- biomass power plant	- high cost - limited regional resource	

Table 15: Summary of KAM's Failure Modes and Effects Analysis (FMEA)

Failure Type	Consequence			Preventative Measures	Response Measures	Likelihood	KAM's Risk Conclusion
	Health & Safety	Environmental	Community				
Pit highwall failure that propagates into Jacko lake resulting in a significant volume of water transferring into the mine pit	Catastrophic	Catastrophic	Catastrophic	Geotechnical investigation and design; De-pressurization of wall; Monitoring of stability with proper reaction to observations (reinforcement of wall, evacuation of pit, evacuation of Jacko Lake); Mine plan will be continuously optimized and refined to ensure long-term stability	Re-establishment of lake	Rare	High
Highwall failure that propagates into Jacko lake resulting in a significant volume of water transferring into the mine pit	Minor	Catastrophic	Catastrophic	Geotechnical investigation and design (2.0 factor of safety minimum); Back-fill; Closure plan will be continuously re-evaluated and optimized to ensure long-term stability	Re-establishment of lake	Rare	High
Over-loading blast holes projecting rocks further than expected	Major	Serious	Major	Blasting procedures; QC of blast loads; Clearing people from the safety blast radius	Emergency response plan (for injuries), including extended search zones; Aquatic and wildlife habitat assessment	Unlikely	Medium

Incorrect delineation of Peterson Creek aquifer extent increasing groundwater flow to the pit	Major	Major	Serious	Water level monitoring in Peterson Creek aquifer; Continue site characterization of underlying material and update models	Consolidation grouting or interception wells to cut off groundwater flow into the pit; Supplement water from Kamloops Lake to compensate the loss to Peterson Creek	Unlikely	Medium
Groundwater seepage from open pit to local aquifer	Minor	Major	Major	Monitor water level in the pit and compare to pit infill model to validate that calculated pit filling are being realized; Monitor groundwater levels; Monitor water quality; Identify fracture patterns and distribution during operations and adjust closure plan as needed	Remediation	Unlikely	Medium
Failure in water-retention from Jacko Lake progressively filling the pit	Minor	Major	Major	Geotechnical investigation and design of the dam; Performance monitoring of the dam. Third-party review and inspection in accordance with established guidelines	Re-establishment of lake	Unlikely	Medium
Break in dewatering pipeline causing a discharge in the environment	Minor	Moderate	Moderate	Controlled drainage; Low-flow alarms to operator that can shutoff the pumps; Preventive maintenance on pipeline; Pipeline protected by berms along access roads	Controlled drainage; Shut pumps down; Replace pipe; pill response plan	Possible	Low
Slope failure of south mine rock storage facility Potential rupture of the Tailings and Reclaimed pipelines which would naturally drain to Humphreys Creek	Minor	Major	Serious	Geotechnical investigation and conservative design; Monitoring of slope movement of the SMRSF	Pumps can be shutdown by operator on low flow or low pressure alarms; Spill contingency plan; Remediation	Unlikely	Medium

Slope failure of south mine rock storage facility Potential impact to Plant site with potential loss of life and causing environmental damage due to the chemicals used in that area	Catastrophic	Major	Major	Geotechnical investigation and conservative design; Monitoring of slope movement	Spill contingency plan; Remediation	Rare	Medium
Slope failure of south mine rock storage facility Potential impact to Kinder-Morgan pipeline releasing hydrocarbons in the environment; Potential impact to Lac Le Jeune and mine roads; Potential impact on Jacko Lake	Minor	Major	Major	Geotechnical investigation and conservative design; Monitoring of slope movement; Pipeline is buried	Spill contingency plan; Remediation	Rare	Medium
Slope Failure of east mine rock storage facility (50m height)	Minor	Major	Major	Geotechnical investigation and conservative design; Monitoring of slope movement; Placement of NPAG material only in this pile	Spill contingency plan; Remediation	Rare	Medium
Slope Failure of south mine rock storage facility or west mine rock storage facility (PAG material)	Minor	Major	Major	Geotechnical investigation and conservative design; Revegetation; Monitoring surface and ground water quality during closure and the period of post-closure monitoring; Updating and revising source terms during the life of Ajax	Re-cap areas that have eroded and remediation of the impacted ecosystems	Rare	Medium
Failure in mine rock management (inappropriate placement of mine rock)	Minor	Major	Major	Operational MLARD monitoring and management plan; Implementation of Environmental monitoring plan; Haul truck Fleet management system; Run-off and seepage collection ponds	Cover systems; Collect and pump to the tailings pond (or to the pit post closure); Remediation; Removal of material to proper storage area	Unlikely	Medium

Containment failure of the tailings or reclaim pipeline	Minor	Major	Serious	Maintenance on pipeline (MAC TSM compliance)	Pressure sensors at strategic locations on pipeline will allow operations to detect leakage and act; Containment ditching along the pipeline; Spill contingency plan; Remediation	Unlikely	Medium
Hazardous material release	Catastrophic	Moderate	Serious	Explosion-proof walls in mixing area; Xanthate mixing electrical classification; Ventilation systems for exposure to hazardous materials; Restricted area	Dedicated concrete pad for unloading transfer areas; Secondary containment for all hazardous materials; Emergency response plan	Unlikely	Low
Fire in the plant	Serious	Minor	Minor	Hot-work permit; NFP compliant/Electrical-code compliant (Division classification)	Fire-fighting capabilities; All run-off water is contained in the plant site; Fire protection and detection systems in the plant site	Possible	Low
Concentrate Truck Accident/Spill	Major	Serious	Serious	Traffic Management Plan (including speed limits and seat belts); Vehicle inspection prior to accessing site; Road maintenance; Safety berms on the road at portion adjacent to Peterson Creek	Spill response plan; Emergency response plan; Remediation activities for the spill	Unlikely	Medium
Fuel Truck Accident/Spill	Major	Major	Major	Traffic Management Plan (including speed limits and seat belts); Vehicle inspection prior to accessing site; Road maintenance	Spill response plan; Emergency response plan; Remediation activities for the spill	Unlikely	Medium
Hazardous Goods Truck Accident/Spill	Major	Major	Major	Traffic Management Plan (including speed limits and seat belts); Vehicle inspection prior to accessing site; Road maintenance; TDG requirements	Spill response plan; Emergency response plan; Remediation activities for the spill	Rare	Medium

Power Failure	Minor	Minor	Minor	Maintenance on transmission line	Emergency generators on critical systems; Emergency response plan; Process plant self-contained	Likely	Low
Accidental explosion at the manufacturing facility (explosive capacity designed to meet 30,000T/year)	Catastrophic	Moderate	Major	Explosives and Blasting Safety Procedure; Minimizing the stored quantities of explosive materials; Fenced secure site with controlled access	Building location (on a hill); Building design (explosion panels); Emergency response plan; Spill response plan	Unlikely	Low
Accidental explosion at the manufacturing facility (explosive capacity designed to meet 30,000T/year)	Catastrophic	Moderate	Major	Explosives and Blasting Safety Procedure; Minimizing the stored quantities of explosive materials; Fenced secure site with controlled access	Building location (on a hill); Building design (explosion panels); Emergency response plan; Spill response plan	Unlikely	Low
Ammonium Nitrate emulsion spill (2 possible locations)	Minor	Moderate	Minor	Explosives and Blasting Safety Procedure; Minimizing the stored quantities of explosive materials; Product transfer done inside the building on adequate flooring surface	Building design (secondary containment); Spill response plan	Possible	Low
Accident/Spill of truck transporting Ammonium Nitrate emulsion (alternative location)	Major	Moderate	Moderate	Traffic Management Plan (including speed limits and seat belts); Vehicle inspection prior to accessing site; Road maintenance; Federal transportation requirements; TDG requirements	Spill response plan; Emergency response plan; Remediation activities for the spill	Unlikely	Low
Structural failure of one of the seepage and collection ponds upgradient of Jacko Lake	Minor	Serious	Serious	Geotechnical investigation and design; Monitoring of the structure	Re-build the dam; Additional water quality monitoring; Potential fishing restrictions at Jacko Lake; Aquatic habitat assessment	Unlikely	Medium

Leakage from one of the seepage and collection ponds up gradient of Jacko Lake	Minor	Serious	Serious	Lined facility (natural or synthetic); Pond level control (during operations); Environmental monitoring plan; Closure and reclamation plan (post-closure)	Additional water monitoring; Potential fishing restrictions at Jacko Lake; Temporary suspension of pumping from Jacko Lake; Aquatic habitat assessment; Repair leak in liner	Unlikely	Medium
Failure of the Central Collection pond liner	Minor	Serious	Moderate	Pond level control; Environmental monitoring plan	Groundwater and surface water quality monitoring; Aquatic habitat assessment; Repair leak in liner	Unlikely	Medium
Failure of the EMR collection pond liner	Minor	Serious	Moderate	Pond level control (during operations); Environmental monitoring plan; Closure and reclamation plan (post-closure)	Groundwater and surface water quality monitoring; Temporary suspension of pumping from Jacko Lake; Aquatic habitat assessment; Repair leak in liner	Unlikely	Medium
Structural failure of the EMR collection pond	Minor	Serious	Moderate	Geotechnical investigation and conservative design; Monitoring of slope movement; Placement of NPAG material only in this pile	Spill contingency plan; Remediation; Re-build the dam	Unlikely	Medium
Failure of the down-stream pond dam (5m height)	Minor	Serious	Major	Site investigation and detail design; Performance monitoring of the dam. Third-party review and inspection in accordance with established guidelines	Re-build the dam; Repair creek and associated infrastructure	Rare	Medium
Grass land / Forest Fire (ex. by cigarette or road incident)	Moderate	Major	Serious	Smoking policies (ex. no smoking in company vehicles, designated smoking areas)	On-site fire department; BC forestry service fire department; Municipal fire department	Unlikely	Medium

Equipment fire	Serious	Minor	Minor	Equipment maintenance program; Operator training (proper equipment use); Speed limits	Fire suppression systems and/or Fire extinguishers; Emergency response plan	Likely	Low
Fuel spill at the truck shop fuel storage location (20,000L spill) due to tank and associated equipment failure	Moderate	Serious	Moderate	Berm around facility; Tank inspection and monitoring; Fueling procedures; Fuel management plan; Physical protection of pump and tanks (protection from impact)	Secondary containment around the tanks; Emergency response plan; Fire suppression systems; Censors; Spill response plan; Spill response kit	Unlikely	Medium
Fuel spill at the haul truck fueling station due to tank and associated equipment failure (100,000L)	Minor	Minor	Minor	Berm around facility; Tank inspection and monitoring; Fueling procedures; Fuel management plan; Physical protection of pump and tanks (protection from impact).	Secondary containment around the tanks; Emergency response plan; Censors; Spill response plan	Unlikely	Low
Repetitive small leaks from fueling stations over the lifetime of Ajax	Minor	Serious	Serious	Secondary containment; Use of spill trays during fueling activities and unloading. Standard operating procedures	Groundwater monitoring; Remediation; Spill response plan	Possible	Medium
Failure of Kinder-Morgan pipeline near Jacko Lake	Minor	Moderate	Major	Kinder-Morgan informs KGHM that there has been a release in proximity of Jacko Lake; Prevention of the release is Kinder-Morgan's responsibility	Stop pumping from Jacko Lake; Assist Kinder Morgan Canada in responding to spill	Rare	Medium

Table 16: Summary of KAM's Tailings Storage Facility Potential Failure Modes Analysis (PFMA)

Failure Type	Positive Factors	Adverse Factors	Mitigation Opportunity	Consequence
Large catastrophic failure triggered by a seismic event and/or high pore pressures leading to deep seated foundation failure and subsequent breach and a release of water into Peterson Creek and off site.	• Factor of Safety is several times higher than design criteria. • 25m of pond water freeboard • Foundation geology consists mostly of compact to very dense glacial deposits overlying competent bedrock. • Most weak layers were identified at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified	• Localized clay later was identified but not fully defined. • Approximately 14m (north side) and 4m (west side) of water North embankment • PMF or large flood volume during construction that exceeds minimum freeboard.	• Use geotechnical instruments to monitor performance, prior to filling of the TSF. • Use internal cofferdam(s) to minimize water against the starter embankment. • Sub excavate weak layers identified at shallow depth (<5m).	Not characterized because of extreme implausibility.
Downstream sliding or slumping failure of the mine rock buttress triggered by seismic event and/or high pore pressures leading to disruption of access road and toe drainage.	• Factor of Safety exceeds design criteria. • Downstream slopes are relatively shallow (3H:1V). • Foundation geology consists mostly of compact to very dense glacial deposits overlying competent bedrock. • Most weak layers were identified at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified. • Mine rock buttress comprised of well-draining rock fill material. • The toe of the Mine Rock Buttress is >100m from startup water pond.	• Localized clay layer was identified but not fully defined. • Rapid construction of mine rock buttress that may lead to increased pore pressure in the foundation.	• Use geotechnical instruments to monitor performance, prior to filling of the TSF. • Sub excavate weak layers identified at shallow depth (<5m).	Unlikely to cause breach and loss of TSF contents.
Upstream failure of the till blanket that is triggered by a seismic event, rapid	• Factor of Safety exceeds design criteria. • Very long seepage path that minimizes flow velocities that reduces internal	• Limited by seasonal construction	• Use geotechnical instruments and construction	Breach and inundation zone that has no or

Failure Type	Positive Factors	Adverse Factors	Mitigation Opportunity	Consequence
drawdown, poor construction and/or high pore pressures leading to uncontrolled seepage.	erosion and potential for piping. • Rock fill materials is not susceptible to erosion and piping. • Spatial and limited time of contact over a relatively small area. Startup pond has limited contact with the upstream face of the starter embankment.	period • Borrow areas are not well defined. • Rapid construction of till blanket that may lead to increased pore pressures and differential settlement.	monitoring to monitor performance, prior to filling of the TSF. • QA/QC of material construction specification of processed engineered fill. • Use additional seepage control, thicker upstream blanket, and internal core zone as a design contingency.	limited effect beyond property boundary.
Piping due to excessive and/or preferential seepage flows through foundation that leads to progressive internal erosion of fill or foundation material starting from the downstream side of the dam or foundation.	• Very long seepage path that minimizes flow velocities that reduces internal erosion and potential for piping. • Till blanket on upstream face of dam, any seepage through fills is limited to liner defects until deposition of tailings, which will line the TSF and will significantly reduce seepage. • Seepage cutoff used to minimize seepage losses through the embankment. • Majority of seepage will be collected within two downstream seepage collection ponds of report to the open pit.	• Loose granular material in the foundation.	• Use deeper cutoff wall to minimize seepage. • Use geotechnical instruments and construction monitoring to monitor performance during construction, prior to filling the TSF.	Breach and inundation zone that has no or limited effect beyond property boundary.
Overtopping due to major precipitation event, and/or inadequate water balance, inadequate freeboard that leads to a rise in impoundment water level	• Freeboard = 25m, which significantly exceeds minimum requirements to accommodate PMF and wave run-up above water elevation.	• None.	• Water management and maintenance of freeboard availability.	Not characterized because of extreme implausibility.

Failure Type	Positive Factors	Adverse Factors	Mitigation Opportunity	Consequence
which eventually overtops and erodes confining embankments.				
Large catastrophic failure triggered by a seismic event and/or high pore pressures leading to deep seated foundation failure and subsequent breach and a release of tailings and water into Peterson Creek and off site.	• Factor of Safety is several times higher than design criteria. • 22m of pond water freeboard • Foundation geology consists mostly of compact to very dense glacial deposits overlying competent bedrock. • Most weak layers were identifies at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified.	• Localized clay layer was identified but not fully defined.	• Use geotechnical instruments to monitor performance. • Sub excavate weak layers identified at shallow depth (<5m).	Not characterized because of extreme implausibility.
Downstream sliding or slumping failure of the Mine Rock Buttress triggered by seismic event and/or high pore pressures to disruption of access roads and toe drainage.	• Factor of Safety exceeds design criteria. • Downstream slopes are relatively shallow (3H:1V). • Foundation geology consists mostly of compact to very dense glacial deposits overlying competent bedrock. • Most weak layers were identified at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified. • Mine rock buttress comprised of well-draining rock fill material. • The toe of the Mine rock buttress is >100m from startup water pond.	• Localized clay layer was identified but not fully defined. • Rapid construction of mine rock buttress that may lead to increased pore pressures in the foundation.	• Use geotechnical instruments to monitor performance. • Sub excavate weak layers identified at shallow depth (<5m).	Unlikely to cause breach and loss of TSF contents.
Piping due to excessive and/or preferential seepage flows through foundation that leads to	• Very long seepage path that minimizes flow velocities that reduced internal erosion and potential for piping. There is a >200m beach length.	• Loose granular material in the foundation. • Very large flood	• Use deeper cutoff wall to minimize seepage. • Use geotechnical	Breach and inundation zone that has no or limited effect

Failure Type	Positive Factors	Adverse Factors	Mitigation Opportunity	Consequence
progressive internal erosion of fill or foundation material starting from the downstream side of the dam or foundation.	• Till blanket and tailings on upstream face of dam and significantly reduces seepage. • Filter zones will manage and control internal seepage through the embankment. • Majority of seepage will be collected within two downstream seepage collection ponds or report to the open pit.	PMF leading to loss of tailings beach length.	instruments and construction monitoring to monito performance during construction.	beyond property boundary.
Overtopping due to major precipitation event, and/or inadequate water balance, inadequate freeboard that leads to a rise in impoundment water level which eventually overtops and erodes confining embankments.	• Freeboard = 22m, which significantly exceeds minimum requirements to accommodate PMF and wave run-up above water elevation. • Sloped tailings beaches push supernatant pond over >400m away from north embankment.	• Water management and maintenance of freeboard availability.	• None.	Not characterized because of extreme implausibility.
Large catastrophic failure triggered by a seismic event and/or high pore pressures leading to deep seated foundation failure and subsequent breach and a release of tailings and water into Peterson Creek and off site.	• Factor of Safety is several times higher than design criteria. • 13m of pond water freeboard • Foundation geology consists mostly of compact to very dense glacial deposits overlying competent bedrock. • Most weak layers were identified at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified.	• Localized clay layer was identified but not fully defined.	• Use geotechnical instruments to monitor performance. • Sub excavate weak layers identified at shallow depth (<5m).	Not characterized because of extreme implausibility.
Downstream sliding or slumping failure of the Mine Rock Storage Facility triggered by seismic event and/or high pore pressures	• Factor of Safety exceeds design criteria. • Downstream slopes are relatively shallow (3H:1V). • Foundation geology consists mostly of compact to very dense glacial deposits	• Localized clay layer was identified but not fully defined. • Rapid construction of Mine Rock	• Use geotechnical instruments to monitor performance. • Sub excavate weak layers identified at	Unlikely to cause breach and loss of TSF contents.

Failure Type	Positive Factors	Adverse Factors	Mitigation Opportunity	Consequence
leading to failure that impacts the downstream North sediment collection ponds and/or Kinder Morgan Canada's Trans Mountain Pipeline	overlying competent bedrock. • Most weak layers were identified at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified. • Mine Rock Storage Facility comprised of well-draining rock fill material.	Storage Facility may lead to increased pore pressures in the foundation.	shallow depth (<5m). • Monitor rate of construction.	
Piping due to excessive and/or preferential seepage flows through foundation that leads to progressive internal erosion of fill or foundation material starting from the downstream side of the dam or foundation.	• Very long seepage path that minimizes flow velocities that reduces internal erosion and potential for piping. There is a >1000m beach length. • Till blanket and tailings on upstream face of dam and significantly reduces seepage. • Filter zones will manage and control internal seepage through the embankment. • Majority of seepage will be collected within two downstream seepage collection ponds or report to the open pit.	• Loose granular material in the foundation.	• Use deeper cutoff wall to minimize seepage. • Use geotechnical instruments and construction monitoring to monitor performance during construction, prior to filling the TSF.	Not characterized because of extreme implausibility.
Overtopping due to major precipitation event, and/or inadequate water balance, inadequate freeboard that leads to a rise in impoundment water level which eventually overtops and erodes confining embankments.	• Freeboard = 13m, which significantly exceeds minimum requirements to accommodate PMF and wave run-up above water elevation. • Sloped tailings beaches push supernatant pond over >1000m away from north embankment.	• None.	• Water management and maintenance of freeboard availability.	Not characterized because of extreme implausibility.
Large catastrophic failure triggered by a seismic event and/or high pore pressures leading to deep	• Factor of Safety is several times higher than design criteria. • 13m of pond water freeboard • Foundation geology consists mostly of	• Localized clay layer was identified but not fully defined.	• Use geotechnical instruments to monitor performance, prior to filling of the	Not characterized because of extreme implausibility.

Failure Type	Positive Factors	Adverse Factors	Mitigation Opportunity	Consequence
seated foundation failure and subsequent breach and a release of tailings and water into Peterson Creek and off site.	compact to very dense glacial deposits overlying competent bedrock. • Most weak layers were identified at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified.		TSF> • Sub excavate weak layers identified at shallow depth (<5m).	
Downstream sliding or slumping failure of the South Mine Rock Storage Facility triggered by seismic event and/or high pore pressures leading to failure that impacts the downstream plant site and infrastructure in close proximity.	• Factor of Safety meets design criteria. • Downstream slopes are relatively shallow (2.5H:1V). • Foundation geology consists mostly of compact to very dense glacial deposits overlying competent bedrock. • Most weak layers were identified at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified. • Mine Rock Storage Facility comprised of well-draining rock fill material.	• Rapid construction of Mine Rock Storage Facility may lead to increased pore pressures in the foundation.	• Use geotechnical instruments to monitor performance, prior to filling of the TSF. • Sub excavate weak layers identified at shallow depth (<5m). • Monitor rate of construction.	Unlikely to cause breach and loss of TSF contents.
Piping due to excessive and/or preferential seepage flows through foundation that leads to progressive internal erosion of fill or foundation material starting from the downstream side of the dam or foundation.	• Very long seepage path that minimizes flow velocities that reduces internal erosion and potential for piping. There is a >700m beach length. • Till blanket and tailings on upstream face of dam and significantly reduces seepage. • Filter zones will manage and control internal seepage through the embankment. • Majority of seepage will be collected within two downstream seepage collection ponds or report to the open pit.	• Loose granular material in the foundation.	• Use deeper cutoff wall to minimize seepage. • Use geotechnical instruments and construction monitoring to monitor performance during construction, prior to filling the TSF.	Not characterized because of extreme implausibility.
Overtopping due to major	• Freeboard = 13m, which significantly	• None.	• Water management	Not characterized

Failure Type	Positive Factors	Adverse Factors	Mitigation Opportunity	Consequence
precipitation event, and/or inadequate water balance, inadequate freeboard that leads to a rise in impoundment water level which eventually overtops and erodes confining embankments.	exceeds minimum requirements to accommodate PMF and wave run-up above water elevation. • Sloped tailings beaches push supernatant pond over >700m away from east embankment.		and maintenance of freeboard availability.	because of extreme implausibility.
Large catastrophic failure triggered by a seismic event and/or high pore pressures leading to deep seated foundation failure and subsequent breach and a release of tailings downstream.	• Factor of Safety is several times higher than design criteria. • 13m of pond water freeboard • Foundation geology consists mostly of compact to very dense glacial deposits overlying competent bedrock. • Most weak layers were identified at shallow depth (<5m), which will be sub excavated out. • Continuous weak layers at depth were not identified.	• Shallow weak unit identified beneath foundation approximately 5m deep.	• Add rock buttress or reduces overall downstream slopes to improve stability. • Provide performance monitoring program to monitor to confirm that no movements within the foundation.	Breach and inundation zone that has no or limited effect beyond property boundary.
Overtopping due to major precipitation event, and/or inadequate water balance, inadequate freeboard that leads to a rise in impoundment water level which eventually overtops and erodes confining embankments.	• Freeboard = 13m, which significantly exceeds minimum requirements to accommodate PMF and wave run-up above water elevation. • Sloped tailings beaches push supernatant pond over >700m away from south embankment.	• None.	• Water management and maintenance of freeboard availability.	Not characterized because of extreme implausibility.

APPENDIX D KEY MITIGATION MEASURES

The following list identifies measures that the Agency considers necessary to mitigate the environmental effects of Ajax. Additional mitigation measures may be articulated in authorizations that may be issued by the federal or provincial governments.

WATER QUALITY AND QUANTITY

- Divert non-contact water back into the Peterson Creek watershed to minimize water losses;
- Construct water management ponds to capture seepage and surface contact water from mine features, such as the tailings storage facility and the mine rock storage facilities;
- Manage tailings storage facility seepage, including an underdrain system in the embankment foundation and a liner system;
- Co-mingle potentially acid generating mine rock with mine rock that has sufficient neutralizing potential to prevent acidic drainage;
- Reclaim mine rock storage facilities with a low permeability till layer overlain with topsoil to reduce infiltration and maximize evapotranspiration and runoff;
- Reclaim the tailings storage facility with a dry cover, to limit infiltration and reduce seepage; and
- Direct surface runoff from the tailings storage facility into the Humphrey Creek watershed.

FISH AND FISH HABITAT

- Implement the proposed Fish Habitat and Fishery Offsetting Plan, including the following offset measures:
- Expand the west arm of Jacko Lake;
- Restore and enhance Upper Peterson Creek at the inlet to Jacko Lake;
- Maintain and enhance Peterson Creek at the outlet of Jacko Lake to maintain SSN's Indigenous fishery; and
- Restore Lower Peterson Creek for approximately 150 m upstream of the confluence with the South Thompson River to improve juvenile salmon habitat.
- Restrict angling and access to Jacko Lake from the mine property for project employees;

- Create blast designs and procedures in consideration of DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat[133], and Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters[134];
- Install a sheet pile dam across the northeast arm of Jacko Lake to exclude fish from the eastern shore and mitigate mortality resulting from blasting near the edge of the open pit;
- Keep underwater pressure and sound levels below the threshold for physical injury to fish, in accordance with National Oceanic and Atmospheric Administration's interim criteria for the onset of physical injury to fish, during installation of the sheet pile dam across the northeast arm of Jacko Lake; and
- Install screens on water intakes taking into consideration DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat, and Freshwater Intake End-of-Pipe Fish Screen Guideline[135], to avoid entrainment and impingement of fish.

VEGETATION

- Minimize the Ajax footprint during development;
- Implement a Reclamation and Closure Plan that includes progressive reclamation and revegetation of the site over the mine life, using native seed mixes and reclaiming 1,440 hectares (mine site, minus the open pit), primarily as grasslands, during decommissioning and closure phases;
- Implement an Invasive Species Management Plan that includes revegetating disturbed areas with native seed mixes, inspecting vehicles for invasive species, washing vehicles to remove invasive species, and direct removal of invasive species;
- Implement a Grassland Restoration and Enhancement Plan on 2,093 hectares of KAM-owned land west of the Ajax infrastructure disturbance area but still within the regional study area;
- Implement a Wetland Offsetting Plan designed to achieve like-for-like offsetting of wetland function loss at a replacement ratio of 2:1 (KAM proposed to create 28.7 hectares of wetlands in total);

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[133] DFO 2013, Measures to Avoid Harm to Fish and Fish Habitat http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html

[134] Wright and Hopky 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. http://www.dfo-mpo.gc.ca/Library/232046.pdf

[135] DFO 1995, Freshwater Intake End of Pipe Fish Screen Guideline. http://www.dfo-mpo.gc.ca/Library/223669.pdf

- Implement measures to avoid and protect Alkaline wing-nerved moss occurrences including the identification of suitable transplant sites;
- Identify and flag exclusion areas for rare plants located adjacent to construction and operation activities and require construction personnel to avoid the exclusion areas;
- Transplant/translocate rare plants that cannot be avoided, based on the guiding principles laid out in the *Best Management Practice: Guidelines for Translocation of Plant Species at Risk in British Columbia*;
- Support regional rare plant surveys and research to determine the distribution of these rare plant species throughout the RSA in order to increase the likelihood of transplant success;
- Limit the use of broadcast spraying intended to control invasive species; and
- Within 200 m of known rare plant occurrences, avoid the use of herbicide sprays.

WILDLIFE

- Install culverts under the Inks Lake Road and at the upgraded interchange to reduce mortality and facilitate badger, amphibian and reptile crossings of this road;
- Confirm the absence or presence of active wildlife activities (e.g. nests, hibernacula, breeding areas) in areas where work is to occur, using a registered professional biologist (qualified professional);
- Flag sensitive areas and avoid vegetation clearing during breeding/rearing periods (March to September, depending on species);
- Conduct pre-clearing surveys to verify animal presence and identify sensitive habitat;
- Implement traffic management to reduce speed limits and ensure vehicles yield to wildlife;
- Avoid sensitive nesting sites (e.g., large diameter trees and snags);
- Establish species-specific buffers around raptor nests if encountered, and relocate known active nests that cannot be avoided;
- Install replacement lek sites. Create two artificial lek sites for every known lek removed or abandoned, and ensure that initial stockpile development occurs outside of the lekking season;
- Limit noise during sensitive times of day (e.g., lekking hours from sunrise to about 10am);
- Introduce duckweed and laying nets over contaminated water bodies to interfere with smooth surfaces (e.g. tailings storage facility) and discourage bat use of contact water;
- Modify habitat adjacent to roads to reduce wildlife suitability, improve driver visibility for wildlife species, and reduce mortality;
- Implement the Spill Contingency Plan to prevent and mitigate the effects of chemical spills;
- Reduce and remove attractants by implementing a Solid Waste Management Plan, Hazardous Waste Management, Surface Water Quality Management and Monitoring Plan;
- Translocate snakes to appropriate habitat, where avoidance is not possible, and construct artificial snake dens, reptile habitat, and roadside berms or culverts/snake crossings;
- Integrate amphibian habitat into wetland compensation sites to avoid breeding sites;
- Reduce and remove attractants that would decrease amphibian reproduction, growth and mortality; and

- Create artificial diversion pools to attract amphibians away from the mine site infrastructure.

AIR QUALITY

- Use covered conveyor from the crusher to the plant;
- Use covered ore stockpiles;
- Install dust collectors on the primary crusher, coarse ore reclaim area, cone crusher area, fine ore stockpile reclaim, and high pressure grinding roller area;
- Use a partially-enclosed primary crusher;
- Minimize haul distances;
- Minimize height from which materials are dropped;
- Apply water on the tailings beach and haul roads to maintain appropriate moisture content and minimize wind erosion and dust emissions;
- Apply dust suppressants on the tailings beach and haul roads, if required, to supplement watering;
- Use polymers in the tailings thickening process to bind fine particles to prevent dust generation, and direct application of polymers to the tailings beach as required;
- Deposit tailings in the tailings storage facility by rotating the spigots to ensure that all areas regularly receive fresh tailings to prevent the generation of dust;
- Grade, compact and maintain roadways, particularly haul roads, to reduce silt content;
- Apply surfactants to the haul roads to improve water efficiency;
- Reclaim exposed surfaces prone to wind erosion to minimize generation of fugitive dust; and
- Re-vegetate disturbed areas (e.g., progressive reclamation), where practical and economically achievable, to minimize dust generation.

HUMAN HEALTH

- Use radio communication instead of a warning horn at night in areas where noise exceedances may occur;
- Use non-tonal (or visual) type backup alarms for mobile equipment;
- Use a mobile dispatch system to minimize equipment congestion; and
- Review and calibrate performance of equipment dispatch software to limit equipment congestion in noise sensitive areas.

CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES

- Communicate with Indigenous groups about when blasting is likely to occur;
- Consider use of non-reflective materials in the construction of buildings and other infrastructure;
- Paint infrastructure with natural colours that blend into the landscape, or screen with tall shrubs or trees;
- Post signage to indicate blasting times and restricted areas to inform hunters at Jacko Lake of available times to access hunting areas;

- Develop an alternate parking lot and road access to facilitate access to Jacko Lake area for cultural/ceremonial use;
- Make reasonable efforts to accommodate working schedules for members of Indigenous groups;
- As part of KAM's corporate social responsibility policy, inform all employees of their duty to respect Indigenous culture and practices;
- Provide support to SSN to participate in accessing, harvesting, and documenting resources of cultural or ceremonial value prior to Ajax footprint disturbance and during project execution;
- Provide regular updates to SSN regarding the amount of resources removed as a result of project operation;
- Explore opportunities to work with the SSN on timber salvage operations;
- Develop and implement an Access Management Plan in consultation with Indigenous groups that includes provision for safe access for SSN members to Jacko Lake throughout the life of Ajax.
- Provide support, as appropriate, to SSN to participate in accessing, harvesting, and documenting plants or other resources of cultural value prior to and during project execution. Identify and describe rare or valued plant communities within the Ajax footprint. Work with SSN to collect seeds, plants, and soil samples to inform future reclamation and closure plans;
- Implement a collaborative approach to reclamation with SSN, which may include providing funding for ongoing reclamation research and incorporating SSN input into identification and siting of plants for re-vegetation; and
- Avoid construction activities within Jacko Lake during spring.

HERITAGE

- Implement a chance-find program involving systematic data recovery or preservation through site capping; and
- Continue to engage SSN in identifying mitigation for ceremonial practices with respect to the Hunting Blind Complex. This may include but is not limited to relocating features of the Hunting Blind Complex to a suitable location identified by the SSN, documenting the Hunting Blind Complex using 3D imagery, preparing a documentary or scaled 3D model of the Hunting Blind Complex for educational purposes, and funding for heritage education or other relevant programming.

ACCIDENTS AND MALFUNCTIONS

- Install horizontal drains to depressurize the pit wall to reduce the likelihood of failure;
- Construct a buttressed pit wall via an in-pit mine rock storage facility;
- Continually optimize the mine plan to ensure the long-term stability of the pit wall;
- Implement active and continuous monitoring of pit wall stability; and
- Implement adaptive management including reinforcement of the pit wall or evacuation if required.

APPENDIX E FOLLOW-UP MEASURES RECOMMENDED BY THE AGENCY

Under the former Act, the responsible authorities are responsible for ensuring the design and implementation of a follow-up program. The following measures have been identified by the Agency for consideration by the responsible authorities as appropriate in designing the follow-up program for Ajax, should it proceed. Additional requirements for follow-up may be articulated in authorizations that may be issued by the federal or provincial governments.

The EAO has proposed mitigation, monitoring and management measures in the draft Table of Conditions, which would be included as Schedule B to the provincial EA Certificate should Ajax proceed. Some of the below plans would be required by provincial and federal ministries or departments, and/or required as part of the proposed EA Certificate conditions.

Valued Component	Description	Timing/Duration	Reporting to
General	Implement an Accidents and Malfunctions Communication Plan to address communication and coordination among the KAM, city, Indigenous groups, and other parties related to project accidents/ incidents with the potential to impact human health or the environment.	All phases	British Columbia
	Implement a Construction Environmental Management Plan (CEMP) to provide guidance on actions and activities to be implemented during construction and commissioning of Ajax. The CEMP would be designed to decrease the risks and the potential for adverse environmental effects associated with construction activities.	Construction	British Columbia
	Implement a public complaints and resolution policy for the construction and operations phase for residents to file complaints regarding Ajax (e.g. related to air quality, water quality, health (including noise).	Construction and Operations	British Columbia
Surface Water and Groundwater Quality and Quantity	Implement a Surface Water and Groundwater Monitoring and Management Plan to ensure water	All phases	ECCC, British Columbia

Valued Component	Description	Timing/Duration	Reporting to
	quality would be within applicable federal and provincial water quality guidelines.		
	Develop and implement hydrogeological investigations, including: Pumping tests around the Edith Lake Fault Zone and Jacko Lake, including installation of additional wells and monitoring instrumentation, to further characterize the groundwater conditions in these areas; Drilling investigations around the Edith Lake Fault Zone to further characterize the structure and properties of the fault; and Evaluation of groundwater quality in the Peterson Creek aquifer at a location nearer to the mine site property boundary than the RES-2 residential well location and upgradient of existing residential wells to further characterize the baseline groundwater quality conditions closer to the mine site. Pursuing options for monitoring private domestic wells Implementing a groundwater monitoring plan in the area between Ajax and Aberdeen prior to construction, in consultation with the City of Kamloops	Pre-construction	British Columbia
Fish and Fish Habitat	Implement a five-year monitoring program to confirm that the proposed offsetting measures are effective, and to determine whether further measures are required for compliance with the *Fisheries Act* authorization.	All phases	DFO
	Finalize the application for the	Pre-construction	DFO

Valued Component	Description	Timing/Duration	Reporting to
	Fisheries Act authorization, including additional information regarding: The quality of littoral habitat present in Jacko Lake; Classification of the type of serious harm to fish (death to fish, permanent alteration or destruction of habitat); Fish density data of various life stages and species throughout the year in lower Peterson Creek; and Habitat complexing of the west arm of Jacko Lake.		
Wildlife	Implement pre-construction Vegetation and Wildlife Surveys in order to avoid or reduce effects to species at risk.	Pre-construction	ECCC, British Columbia
	Monitor the use of tailings storage facility by migratory birds and bats.	All phases	ECCC, MFLNR
	Monitor water quality within wetland compensation areas, particularly shallow, open water habitats to determine suitability for wildlife.	All phases	ECCC, MFLNR
	Implement a Wildlife Management and Monitoring Program, including: Species-specific buffers around any raptor nests that are encountered; Active raptor nest monitoring during blasting, until the young have fledged (anticipated to be mid-July or earlier in most instances) or the nest has failed, at which time the buffer will be lifted; Annual monitoring of known, artificial and replacement sharp-tailed grouse leks following RIC standards; Badger monitoring through incidental observations and a DNA hair-snagging program;	All phases	MFLNR

Valued Component	Description	Timing/Duration	Reporting to
	On-site bird, mammal, and amphibian monitoring, which will be conducted annually and include recording of incidental observations, breeding evidence, mortality events and/or interactions with project infrastructure; Data from monitoring programs, which will be analyzed using best practices and assessed for statistical power to detect changes in wildlife populations or habitat availability; Monitoring data, analyses, and power analyses, which will be reported in a monitoring report; and Adaptive management, which will be implemented if local-area effects are reported for a wildlife VC, or if the monitoring report shows a decline in the VC population near Ajax compared to control areas.		
Vegetation	Implement a Wildlife Management and Monitoring Plan that includes ongoing management of effects to rare plants, grasslands and issues related to management for invasive plants assessed in the EA.	All phases	ECCC, British Columbia
	Implement a Grasslands Restoration and Enhancement Program to address the time lag in grasslands reclamation and the uncertainty in the effectiveness of grasslands reclamation efforts, and to enhance grassland function and health, with related benefits to grassland-dependent species.	All phases	ECCC, British Columbia
	Implement a Wetland Compensation Plan to address the time lag in restoring destroyed wetlands on the mine site and the uncertainty about	All phases	ECCC, MFLNR

Valued Component	Description	Timing/Duration	Reporting to
	whether wetlands can be recreated during reclamation and achieve full functionality.		
Air Quality	Implement an Air Quality Management Plan, which would include an outline of regulatory monitoring and reporting requirements. KAM's Fugitive Dust Management Plan (which includes a Dust Action Response Plan) would be implemented in conjunction with the Air Quality Management Plan and would describe the specific mitigation measures, monitoring and adaptive management approach that KAM would apply for emissions of particulate matter (TSP, PM_{10}, $PM_{2.5}$) and dustfall.	All phases, starting in pre-construction	British Columbia
Human Health	Monitor arsenic in groundwater in the Peterson Creek Aquifer.	All phases	British Columbia
	Monitor changes in metal concentrations in soil and vegetation. Backyard produce will be sampled for a period of 5 years.	All phases	British Columbia
	Monitor fish tissue and whole bodies of fish as part of the on-going Fish and Fish Habitat monitoring program. If additional data shows a substantive change in metal concentrations in fish, the results of the HHRA related to fish consumption will be reviewed to determine whether additional mitigation is necessary.	All phases	DFO, British Columbia
	Review the ongoing Fish and Fish Habitat, surface and groundwater, air quality, noise and vibration monitoring programs for Ajax. Implement an adaptive management strategy and additional mitigations if updates to the HHRA based on	All phases	Health Canada, British Columbia

Valued Component	Description	Timing/Duration	Reporting to
	monitoring results that vary from predicted effects indicate that additional measures are appropriate. Should additional mitigation be appropriate, provide an action plan outlining proposed mitigative actions.		
Current Use of Land and Resources for Traditional Purposes	Conduct Indigenous Engagement and Reporting, including establishing a committee with SSN to facilitate implementation of mitigation and monitoring plans for biophysical components. Biophysical effects monitoring would contribute to determining whether or not there is a change in the opportunity to conduct ceremonial activities.	All phases	British Columbia
Heritage	Visually examine archaeological sites in close proximity to construction activities during and after construction activities.	Construction and Operations	British Columbia
	Visually examine archaeological sites between 150 m and 500 m of construction activities on an annual basis. Should effects to these archaeological sites be observed, KAM would consult with the Archaeology Branch in the development of appropriate mitigation measures to minimize further impacts, which may include detailed mapping, photography, systematic data recovery, or site capping.	Construction and Operations	British Columbia

APPENDIX F WORKING GROUP MEMBER AFFILIATIONS

Organization
City of Kamloops
Environment and Climate Change Canada
Fisheries and Oceans Canada
Health Canada
Interior Health
Lower Nicola Indian Band
Ministry of Agriculture
Ministry of Energy and Mines
Ministry of Environment
Ministry of Forests, Lands and Natural Resource Operations
Ministry of Jobs, Tourism and Skills Training
Ministry of Transportation and Infrastructure
Natural Resources Canada
Skeetchestn Indian Band
Stk'emlupsemc te Secwepemc Nation
Thompson-Nicola Regional District
Tk'emlúps te Secwépemc (Tk'emlúps Indian Band)